MWH

BUILDING A BETTER WORLD

April 8, 2014

Mr. Dave Tomten
U.S. Environmental Protection Agency
1435 N. Orchard Street
Boise, ID 83706

RE: P4 Long-Term Surface Water and Groundwater Monitoring Plan - Final Rev 1 - 2014

Dear Dave:

This memorandum is a follow-on to the 2013 *Proposed P4 Long-Term Surface Water and Groundwater Monitoring Plan – Final Rev 1* Letter (*2013 LTM Plan*; MWH, 2013) and presents several changes/clarifications to the proposed 2014 surface water (SW) and groundwater (GW) long-term monitoring (LTM) plans. The LTM is being performed at the P4 Production, L.L.C. (P4) inactive mine sites located north of Soda Springs, Idaho and in accordance with the requirements in the 2009 Administrative Settlement Agreement and Order on Consent/Consent Order for the Remedial Investigation/Feasibility Study (2009 AOC/ CO; RI/FS) with the US Environmental Protection Agency (USEPA) Region 10 and other named federal and state agencies. The monitored P4's mine sites include: Ballard, Henry, and Enoch Valley mines, collectively referred to as the Sites, which are the focus of the 2009 AOC/CO.

The changes proposed in this letter are intended to refine the *2013 LTM Plan* and continue the transition of the past sampling programs from interim plans and site characterization to a defined long-term monitoring program. As conducted in the past, it is anticipated that the 2014 LTM sampling program for GW and SW will be performed during two sampling rounds each year; one in the spring for both SW and GW and the other in the fall for SW only. The 2014 LTM program will continue to support the RI/FS process including the evaluation of the individual mine site remedies during the FS and to document individual Site changes that might be expected following implementation of the Selected Remedy. The proposed 2014 LTM SW and GW monitoring objectives and program are described in more detail below.

Proposed 2014 Long-Term Monitoring Program for Surface Water

The objective of SW monitoring conducted at the Sites from 2004 through 2008 was to support nature and extent characterizations of impacts to water quality associated with releases to SW from potential sources. In 2009, the SW monitoring program transitioned from a characterization to an interim monitoring program that provides an annual assessment of SW conditions downstream of potential sources associated with each Site. The objective of the sampling conducted since 2009 is to establish long-term data trends and assist with the development of site-specific remedies at individual mines. The details of the 2009/2010 interim monitoring plan, including data quality objectives (DQOs) and the field sampling plan (FSP), are included in the A/T-approved *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan - Final Revision 2* (*2009/2010 Surface Water SAP*; MWH, 2009a). This document is included as Attachment 1.

Additional sampling also was performed in 2012 and 2013 under the A/T-approved technical memorandums entitled *2012 Surface and Groundwater Monitoring Programs - Final Revision 2* (*2012 Surface Water and Groundwater Memo*; MWH, 2012a) and *Proposed 2013 LTM Plan* (MWH, 2013) respectively. The objectives of the 2012 and 2013 monitoring were the same as the 2009/2010 monitoring program and these same objectives are proposed for the current 2014 LTM program.

The 2014 and future monitoring program will follow 2013 monitoring program with no changes made to the SW sampling program. The key elements of the 2014 LTM monitoring program for both SW and GW are summarized on Table 1 – *2014 LTM Surface Water and Groundwater Analyte List,* Table 2 – *2014 LTM Surface Water Monitoring Locations, Frequency and Schedule*, and Table 3 - *2014 LTM Spring Sample Tracker for Surface Water Stations*. The sample collection and analysis will be performed according to the methods and procedures outlined in the *2009/2010 Surface Water SAP and FSP* included as Attachment 1 to this letter. Figure 1 presents the LTM SW locations on a topographic map with all three Sites included. Figures 2 through 4 present the SW locations on an aerial, photographic background for each individual Site.

As shown on Table 2, a subset of the SW monitoring locations will be re-evaluated after the spring 2014 LTM sampling event, as has been done previously, to determine whether they will be sampled in the fall 2014 LTM sampling event. Those sampling locations with consistently higher selenium and sulfate concentrations in the fall, as compared to spring, will be retained for fall sampling. The fall sampling decision will use both the spring 2014 LTM data and historical data to determine which stations, if any, need to be re-sampled in the fall. For any stations that need to be re-sampled in the fall, a 2014 LTM Fall Sample Tracker table will be prepared and each of the locations with be visited. The 2014 LTM Fall Sample Tracker table and rationale for fall stations will be provided to the A/T at least three weeks prior to the fall sample event. On dry or drought years many/most of the selected locations will be dry during the fall round of sampling and as a result, no sample will be collected at the dry stations. It should be noted that the number or frequency of SW sample locations did not change from the *2013 LTM Plan.*

Proposed 2014 Long-Term Monitoring Program for Groundwater

Characterization of GW at the Sites has been conducted in a phased approach since 2004 and the spatial/categorical relevance of individual GW monitoring locations and the analyte list were evaluated as part of the

- *2009 Groundwater Monitoring Sampling and Analysis Plan (2009 Groundwater SAP; MWH, 2009b),*
- *2010 Groundwater Monitoring Memorandum (2010 Groundwater Memo; MWH, 2010)*,
- *2012 Surface Water and Groundwater Memo, and the*
- 2013 *LTM Plan.*

These plans are included as Attachments 2, 3, 4, and 5 to this letter. The objectives of the GW monitoring that occurred in the 2010, 2012, and 2013 sampling programs are essentially the same. The groundwater data collected under these plans support the evaluation of SW / GW interaction and refinement of the hydrogeologic conceptual models of the Sites. In addition, ongoing LTM monitoring of GW constituents concentrations and piezometric conditions in monitoring wells are needed to support the evaluation of remedies in the FS and implementation of the sites Selected Remedies during any corrective action that may be necessary. Sampling of these monitoring well locations also allows for an understanding of potential long-term GW trends, especially following the implementation of the Selected Remedy at each of the Sites.

The 2014 LTM GW program will mimic the 2013 program with one exception:

- Two additional GW samples will be collected during the 2014 Spring sampling round from two wells (MBW011 and SB-07) located near the Ballard Shop during the Spring 2014 SW and GW LTM Program. These samples are being collected to address recommendations made in the *Remedial Investigation (RI) Report for P4's Ballard Mine – Draft Rev 0[Ballard RI]*(MWH, 2014a). It should be noted that these samples are a one-time collection event, pending results, and are not currently part of the LTM program. In an effort to maximize sampling efficiency these samples will be collected during the Spring 2014 LTM sampling event. The *Proposed Ballard Shop Monitoring Well Sample Collection in Addition to the P4 Long-Term Surface Water and Groundwater Monitoring Plan -Draft Rev 0 – 2014* (MWH, 2014b) provides details regarding the collection of these additional samples.

The key elements of the LTM GW monitoring program are summarized on:

- Table 1 - *2014 LTM Surface Water and Groundwater Analyte List*,
- Table 4 - *2014 LTM Groundwater Locations, Frequency and Schedule*
- Table 5 – *2014 LTM Spring Sample Tracker for Groundwater Stations*.

As shown on Table 4, no fall GW sampling is proposed. As discussed previously, a review of historical selenium and sulfate data does not support additional fall GW sampling events. The GW sample collection and analysis will be performed according to the methods and procedures outlined within the *2009 Groundwater Monitoring SAP* (Attachment 2). Figure 1 presents the LTM GW locations on a topographic map with all three Sites included. Figures 2 through 4 present the LTM GW locations on an aerial, photographic background for each individual Site. It should be noted that the number or frequency of GW sample locations did not change from the *2013 LTM Plan*. P4 will continue to submit all validated data and data validation summaries for each sampling effort within 120 days of sample collection as required by Task B Data Management in the 2009 AOC/CO Scope of Work (SOW). In addition, yearly Data Summary Reports will be submitted to the A/T per the AOC/CO SOW.

We appreciate your timely review of the proposed sampling program. P4 anticipates sampling to begin in May 2014 based on snowpack and runoff conditions. You will be notified of the pending sampling rounds as in the past. If you have any questions or comments on this proposed sampling event, please do not hesitate to contact Rachel Roskelley at (208) 547-1248, or me at (801) 617-3250.

Best Regards,

Vance Drain, P.G.
Project Manager

Distribution:

Dave Tomten, USEPA
Tim Mosko, CH2M Hill
Michael Rowe, IDEQ
Gerry Winter, IDEQ
Jeff Fromm, IDEQ

Caribou National Forest, Soda Springs District Office
Gary Billman, IDL
Carolann Cole, North Wind Inc.
Kelly Wright, Shoshone-Bannock Tribes
Susan Hanson, Shoshone-Bannock Tribes
Talia Martin, Shoshone-Bannock Tribes
Jeffrey Cundick, BLM
Bruce Narloch, MWH
Randy White, Monsanto
Vance Drain, MWH
MWH Project File

Joe Wallace, USEPA
Lorraine Edmond, USEPA
Bruce Olenick, IDEQ
Sherri Clark,USDA- FS
Mary Kauffman, USDA-FS

Eldine Stevens, BIA
Mark Jankowski, USFWS
Sandi Fisher, USFWS
Robert Blaesing, BIA
Randy Vranes, Monsanto/P4
Rachel Roskelley, Monsanto/P4
Colleen O'Hara-Epperly, BLM
Celeste Christensen, MWH
Cary Foulk, MWH
Leah Wolf-Martin, WMI
MWH1007903@portal.mwhglobal.com

References

2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan - Final Revision 2 (2009/2010 Surface Water SAP; MWH, 2009a).

2009 Groundwater Monitoring Sampling and Analysis Plan (2009 Groundwater SAP; MWH, 2009b),

2010 Groundwater Monitoring Memorandum (2010 Groundwater Memo; MWH, 2010)

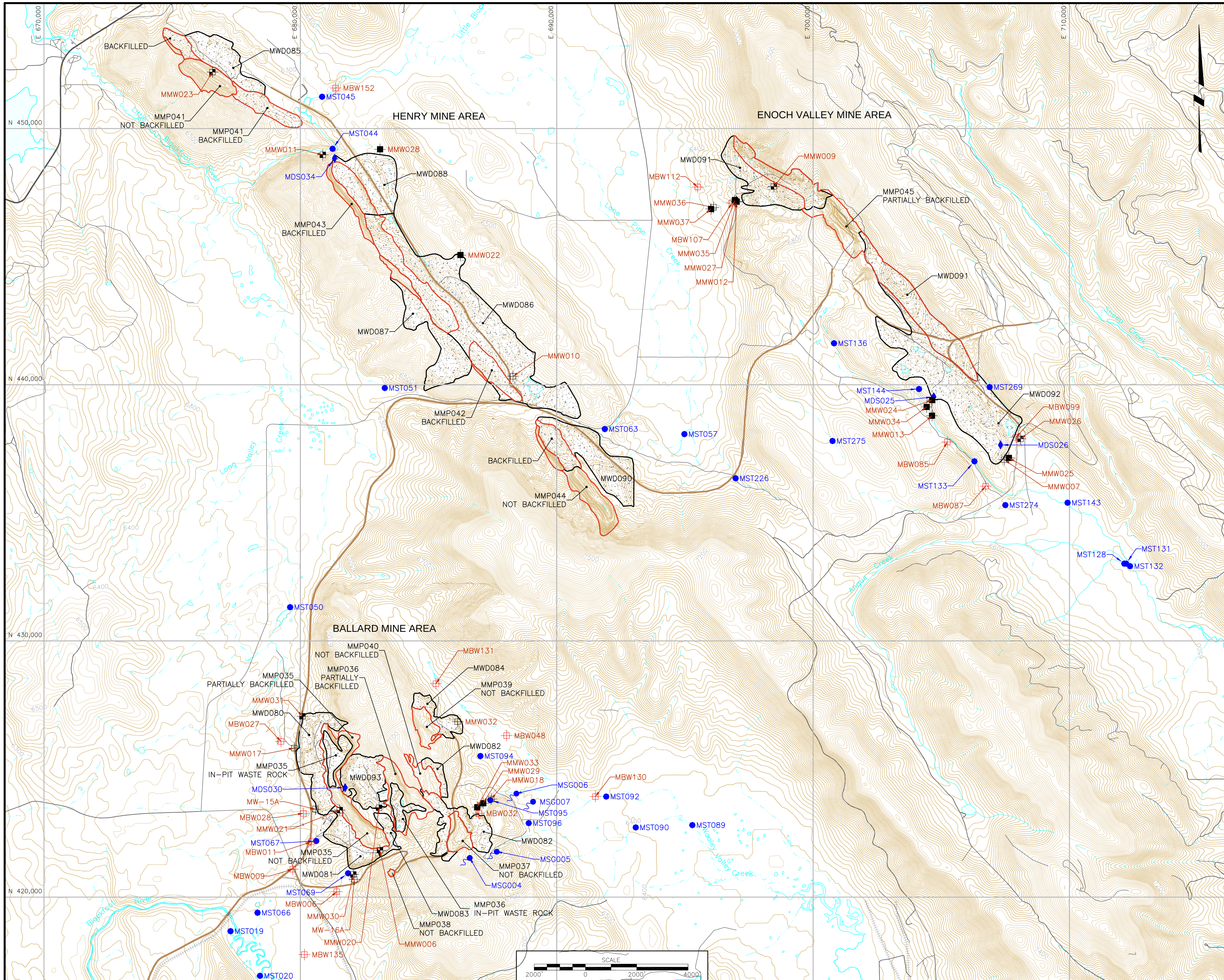
2012 Surface and Groundwater Monitoring Programs - Final Revision 2 (2012 Surface Water and Groundwater Memo; MWH, 2012).

2013 Proposed P4 Long-Term Surface Water and Groundwater Monitoring Plan – Final Rev1 (2013 LTM Plan; MWH, 2013.)

2014a Remedial Investigation Report for P4's Ballard Mine – Draft Rev0 – (2014 Ballard RI; MWH, 2014).

2014b Proposed Ballard Shop Monitoring Well Sample Collection in Addition to the P4 Long-Term Surface Water and Groundwater Monitoring Plan -Draft Rev 0 – 2014 (MWH, 2014b)

FIGURES



LEGEND:

- POST-MINE CONTOUR AND ELEVATION, FEET (APPROXIMATE)
- RIVER
- POND OR LAKE
- NATURAL DRAINAGE – PERENNIAL
- NATURAL DRAINAGE – INTERMITTENT
- HIGHWAY
- ROAD
- MONSANTO HAUL ROAD (ACTIVE & INACTIVE)
- RAILROAD
- MINE PIT LOCATION (APPROXIMATE WHERE COVERED BY BACKFILL)
- WASTE ROCK DUMP LOCATION (APPROXIMATE)
- WASTE ROCK DUMP LOCATION OR PIT BACKFILL (APPROXIMATE)

STATION TYPE:

- MMW = MONITORING WELL
- MMW = ALLUVIAL AQUIFER MONITORING WELL
- MMW = INTERMEDIATE AQUIFER MONITORING WELL (GENERALLY DINWOODY FM.)
- MMW = REGIONAL AQUIFER MONITORING WELL (WELLS FM.)
- MBW = DIRECT-PUSH ALLUVIAL AQUIFER WELL
- MDS = DUMP SEEP SAMPLE LOCATION
- MSG = SPRING SAMPLE LOCATION
- MST = STREAM SAMPLE LOCATION

- RED LOCATIONS ARE GROUNDWATER MONITORING WELL LOCATIONS THAT WILL BE SAMPLED.
- BLUE LOCATIONS ARE SURFACE WATER LOCATIONS THAT WILL BE SAMPLED
- BLACK LOCATIONS ARE GROUNDWATER MONITORING WELL OR SURFACE WATER LOCATIONS THAT WILL NOT BE SAMPLED

KEY:

MMP = MINE PIT
MWD = WASTE ROCK DUMP

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
0	FINAL	CF	EY	02/10/14

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
1. POST-MINE TOPOGRAPHY GENERATED FROM:
- USGS DIGITAL ELEVATION MODELS (DEM)-24K.
- SURVEY DATA FOR BALLARD MINE PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: JUNE 2005.
- SURVEY DATA FOR HENRY MINE AREA PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: NOVEMBER 2008.
- SURVEY DATA FOR ENOCH VALLEY MINE AREA PROVIDED BY P4 PRODUCTION DATED: DECEMBER 2007.
- US CENSUS BUREAU 2007 TIGER LINE DATA

PROJECTION: STATE PLANE COORDINATE SYSTEM
ZONE: IDAHO EAST
HORIZONTAL DATUM: NAD27
VERTICAL DATUM: NGVD29
UNITS: U.S. FEET

DESIGNED BY	E YEAGER	02/10/14
DRAWN BY	C FOWLER	02/10/14
CHECKED BY	E YEAGER	02/10/14
APPROVED BY	V DRAIN	02/10/14
PROJECT MANAGER		
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 Production, LLC

PROJECT LOCATION
BALLARD, HENRY AND ENOCH VALLEY MINES

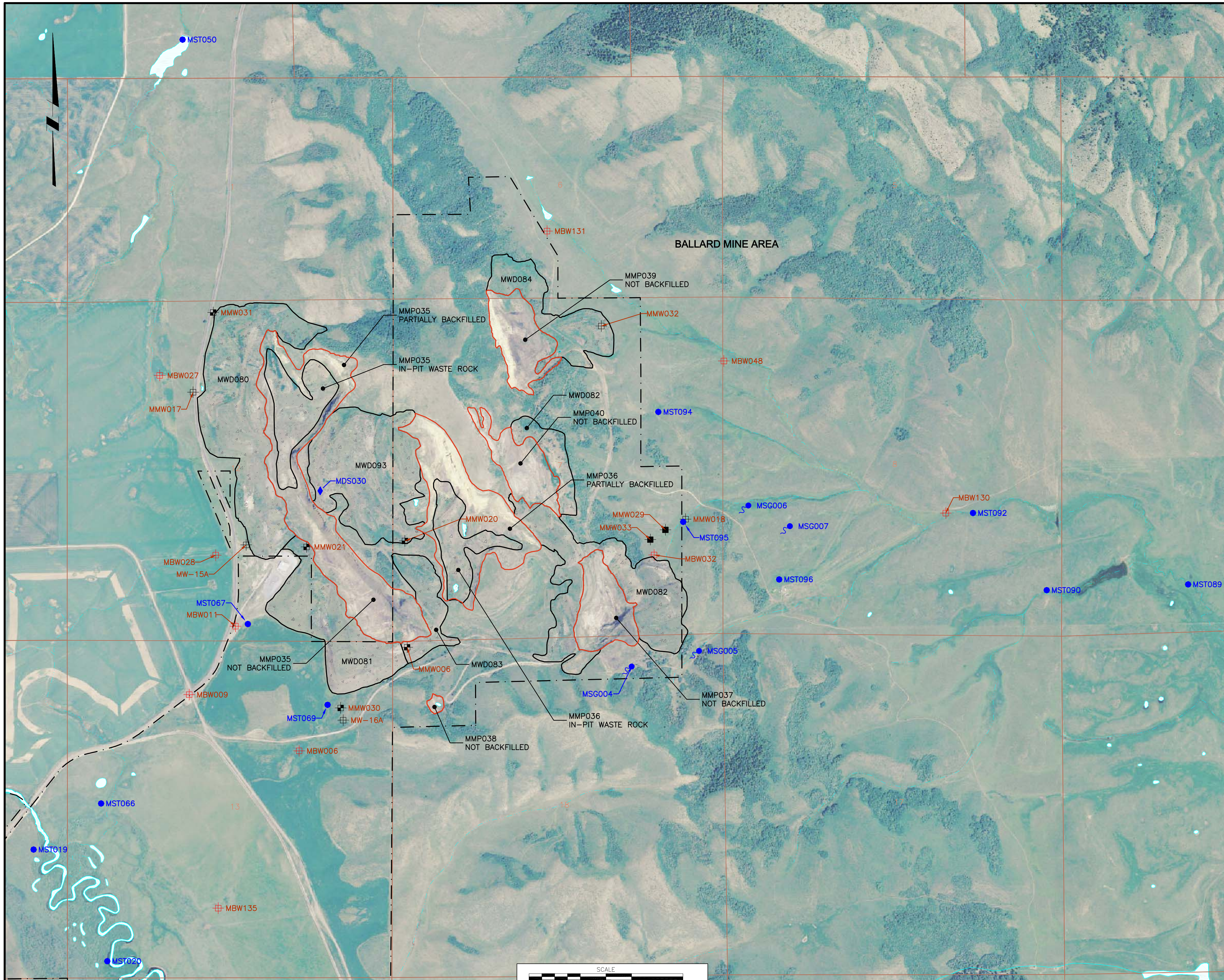
PROJECT
LONG-TERM MONITORING PLAN

TITLE
P4 SITES - SURFACE WATER AND GROUNDWATER SAMPLE LOCATIONS

MWH

SHEET 1
REVISION 0
FILE NAME 10500676D002

N:\design-drafting\clients_i-p\monsanto company 2013\10500676 2012 spring fall sampling\013-sheet set\10500676D002



LEGEND:

- MINE PIT LOCATION (APPROXIMATE WHERE COVERED BY BACKFILL)
- WASTE ROCK DUMP LOCATION (APPROXIMATE)
- WASTE ROCK DUMP LOCATION OR PIT BACKFILL (APPROXIMATE)
- POND OR LAKE
- P4 PRODUCTION PROPERTY BOUNDARY (APPROXIMATE)
- SECTION LINES
- 8 SECTION NUMBER

STATION TYPE:

- MMW = MONITORING WELL
- MMW = ALLUVIAL AQUIFER MONITORING WELL
- MMW = INTERMEDIATE AQUIFER MONITORING WELL (GENERALLY DINWOODY FM.)
- MMW = REGIONAL AQUIFER MONITORING WELL (WELLS FM.)
- MBW = DIRECT-PUSH ALLUVIAL AQUIFER WELL
- MDS = DUMP SEEP SAMPLE LOCATION
- MSG = SPRING SAMPLE LOCATION
- MST = STREAM SAMPLE LOCATION

- RED LOCATIONS ARE GROUNDWATER MONITORING WELL LOCATIONS THAT WILL BE SAMPLED.
- BLUE LOCATIONS ARE SURFACE WATER LOCATIONS THAT WILL BE SAMPLED
- BLACK LOCATIONS ARE GROUNDWATER MONITORING WELL OR SURFACE WATER LOCATIONS THAT WILL NOT BE SAMPLED

KEY:

MMP = MINE PIT
MWD = WASTE ROCK DUMP

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
0	FINAL	CF	EY	02/10/14

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
1. POST-MINE TOPOGRAPHY GENERATED FROM:
   - USGS DIGITAL ELEVATION MODELS (DEM)-24K.
   - SURVEY DATA FOR BALLARD MINE PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: JUNE 2005.
   - SURVEY DATA FOR HENRY MINE AREA PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: NOVEMBER 2008.
   - SURVEY DATA FOR ENOCH VALLEY MINE AREA PROVIDED BY P4 PRODUCTION DATED: DECEMBER 2007.
   - US CENSUS BUREAU 2007 TIGER LINE DATA

PROJECTION: STATE PLANE COORDINATE SYSTEM
ZONE: IDAHO EAST
HORIZONTAL DATUM: NAD27
VERTICAL DATUM: NGVD29
UNITS: U.S. FEET

DESIGNED BY	E YEAGER	02/10/14
DRAWN BY	C FOWLER	02/10/14
CHECKED BY	E YEAGER	02/10/14
APPROVED BY	V DRAIN	02/10/14
PROJECT MANAGER		
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

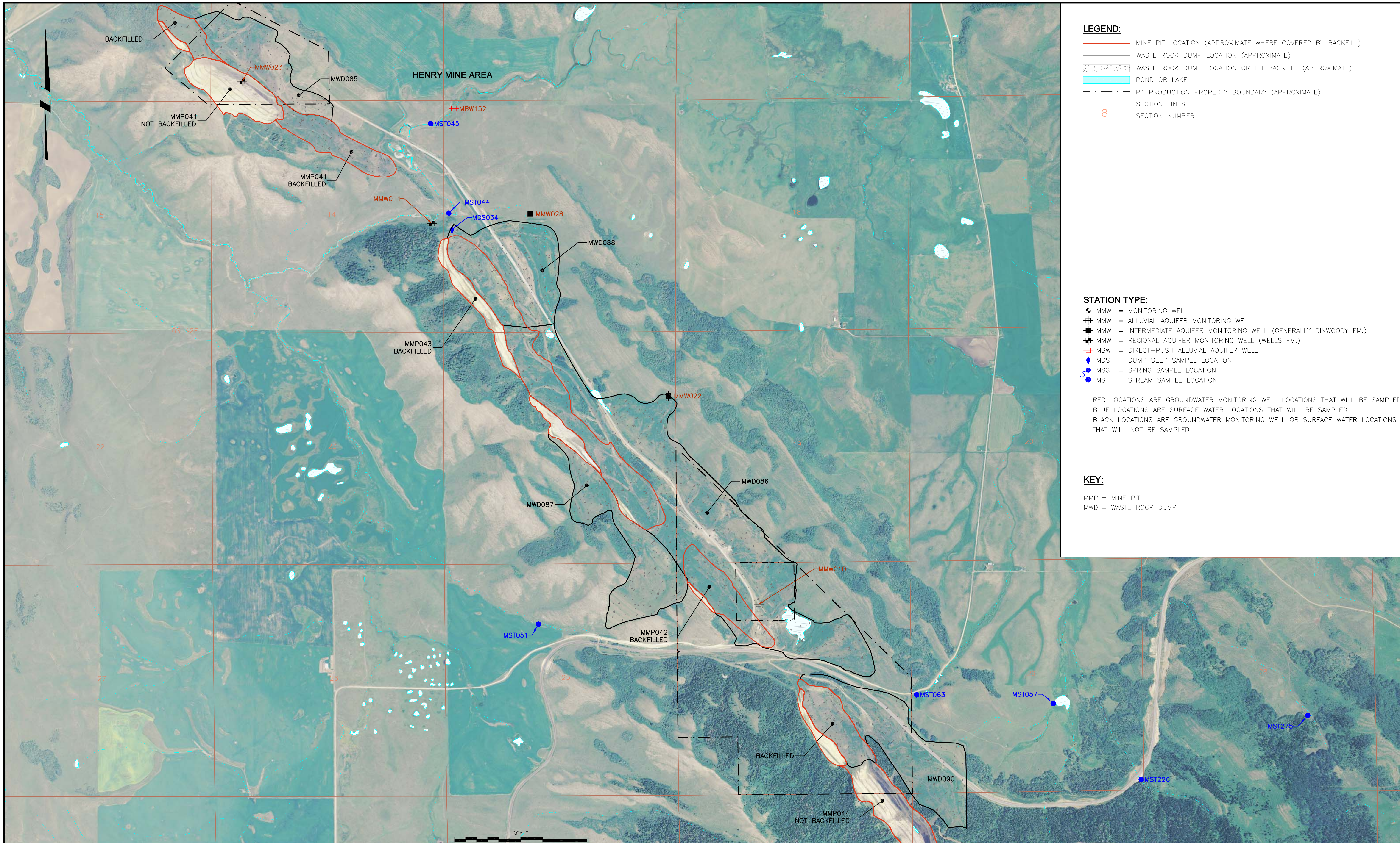
P4 Production, LLC

PROJECT LOCATION: BALLARD, HENRY AND ENOCH VALLEY MINES
PROJECT: LONG-TERM MONITORING PLAN
TITLE: BALLARD MINE - SURFACE WATER AND GROUNDWATER SAMPLE LOCATIONS

MWH

SHEET: 2
REVISION: 0
FILE NAME: 10500676D003

N:\design-drafting\clients_i-p\monsanto company 2013\10500676 2012 spring fall sampling\013-sheet set\10500676D003



ISSUE REV	DESCRIPTION	TECH	ENG	DATE
0	FINAL	CF	EY	02/10/14

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
1. POST–MINE TOPOGRAPHY GENERATED FROM:
   - USGS DIGITAL ELEVATION MODELS (DEM)–24K.
   - SURVEY DATA FOR BALLARD MINE PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: JUNE 2005.
   - SURVEY DATA FOR HENRY MINE AREA PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: NOVEMBER 2008.
   - SURVEY DATA FOR ENOCH VALLEY MINE AREA PROVIDED BY P4 PRODUCTION DATED: DECEMBER 2007.
   - US CENSUS BUREAU 2007 TIGER LINE DATA

PROJECTION: STATE PLANE COORDINATE SYSTEM
ZONE: IDAHO EAST
HORIZONTAL DATUM: NAD27
VERTICAL DATUM: NGVD29
UNITS: U.S. FEET

DESIGNED BY	E YEAGER	02/10/14
DRAWN BY	C FOWLER	02/10/14
CHECKED BY	E YEAGER	02/10/14
APPROVED BY	V DRAIN	02/10/14
PROJECT MANAGER		
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 Production, LLC

PROJECT LOCATION: BALLARD, HENRY AND ENOCH VALLEY MINES

PROJECT: LONG-TERM MONITORING PLAN

TITLE: HENRY MINE - SURFACE WATER AND GROUNDWATER SAMPLE LOCATIONS

MWH

SHEET: 3 REVISION: 0

FILE NAME: 10500676D001

N:\design-drafting\clients_i-p\monsanto company 2013\10500676 2012 spring fall sampling\013-sheet set\10500676D001

SCALE

1000 0 1000 2000 FT

LEGEND:

- MINE PIT LOCATION (APPROXIMATE WHERE COVERED BY BACKFILL)
- WASTE ROCK DUMP LOCATION (APPROXIMATE)
- WASTE ROCK DUMP LOCATION OR PIT BACKFILL (APPROXIMATE)
- POND OR LAKE
- P4 PRODUCTION PROPERTY BOUNDARY (APPROXIMATE)
- SECTION LINES
- 8 SECTION NUMBER

STATION TYPE:

- MMW = MONITORING WELL
- MMW = ALLUVIAL AQUIFER MONITORING WELL
- MMW = INTERMEDIATE AQUIFER MONITORING WELL (GENERALLY DINWOODY FM.)
- MMW = REGIONAL AQUIFER MONITORING WELL (WELLS FM.)
- MBW = DIRECT-PUSH ALLUVIAL AQUIFER WELL
- MDS = DUMP SEEP SAMPLE LOCATION
- MSG = SPRING SAMPLE LOCATION
- MST = STREAM SAMPLE LOCATION

- RED LOCATIONS ARE GROUNDWATER MONITORING WELL LOCATIONS THAT WILL BE SAMPLED.
- BLUE LOCATIONS ARE SURFACE WATER LOCATIONS THAT WILL BE SAMPLED
- BLACK LOCATIONS ARE GROUNDWATER MONITORING WELL OR SURFACE WATER LOCATIONS THAT WILL NOT BE SAMPLED

KEY:

MMP = MINE PIT
MWD = WASTE ROCK DUMP

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
0	FINAL	CF	EY	02/10/14

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
1. POST-MINE TOPOGRAPHY GENERATED FROM:
   - USGS DIGITAL ELEVATION MODELS (DEM)-24K.
   - SURVEY DATA FOR BALLARD MINE PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: JUNE 2005.
   - SURVEY DATA FOR HENRY MINE AREA PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: NOVEMBER 2008.
   - SURVEY DATA FOR ENOCH VALLEY MINE AREA PROVIDED BY P4 PRODUCTION DATED: DECEMBER 2007.
   - US CENSUS BUREAU 2007 TIGER LINE DATA

PROJECTION: STATE PLANE COORDINATE SYSTEM
ZONE: IDAHO EAST
HORIZONTAL DATUM: NAD27
VERTICAL DATUM: NGVD29
UNITS: U.S. FEET

DESIGNED BY	E YEAGER	02/10/14
DRAWN BY	C FOWLER	02/10/14
CHECKED BY	E YEAGER	02/10/14
APPROVED BY	V DRAIN	02/10/14
PROJECT MANAGER		
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 Production, LLC

PROJECT LOCATION: BALLARD, HENRY AND ENOCH VALLEY MINES

PROJECT: LONG-TERM MONITORING PLAN

TITLE: ENOCH VALLEY MINE - SURFACE WATER AND GROUNDWATER SAMPLE LOCATIONS

MWH

SHEET: 4
REVISION: 0
FILE NAME: 10500676D004

N:\design-drafting\clients_i-p\monsanto company 2013\10500676 2012 spring fall sampling\013-sheet set\10500676D004

TABLES

TABLE 1
2014 LTM SURFACE WATER AND GROUNDWATER
ANALYTE LIST

Category	Fraction	Analytes (Analytical Method)
Surface Water		
Streams , Seeps, and Springs,	Unfiltered Filtered Filtered Filtered Filtered Unfiltered Unfiltered	Se (EPA 6020A) Cd, Se (EPA 6020A) V (EPA 6010B) Ca, Mg (EPA 6010B)[a] SO_4 (EPA 300.0) TDS (EPA 160.1) Field Parameters[b]
Groundwater		
Monitoring Wells and Direct Push Borehole Wells[c]	Unfiltered[d] Filtered Filtered Unfiltered Unfiltered	*Primary Analyte List* Cd, Mn, Se (EPA 6020A) Se (EPA 6020A) SO_4 (EPA 300.0) TDS (EPA 160.1) Field Parameters[b]

Notes:

[a]Hardness is calculated on filtered fractions of Ca and Mg

[b]Field Parameters are listed on Table 3 and Table 5.

[c]Borehole Monitoring Wells (direct push) are differentiated from “regular or standard” monitoring wells based on their methods and means of completion. In general, they have a smaller diameter and a shorter pre-packed screened interval than the regular monitoring wells.

[d]Direct-push monitoring wells may be sampled for dissolved or dissolved and total fractions depending on turbidity (see *2010 Groundwater SAP*).

Ca - Calcium
Cd - Cadmium
Mg – Magnesium
Mn - Manganese
Se - Selenium
SO_4 - Sulfate
TDS - Total Dissolved Solids
V - Vanadium

TABLE 2
2014 LTM SURFACE WATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE

Mine	Station ID[a]	Feature Name[b]	Location[c]		Sample Schedule	
			Latitude	Longitude	Spring	Fall[d]
Ballard Mine	MST019	Blackfoot River below Ballard Creek	42 48 49.28	111 30 21.52	X	TBD
	MST020	Blackfoot River below State Land Creek	42 48 31.97	111 30 06.28	X	TBD
	MST050	*Long Valley Creek* below Ballard Mine	42 50 54.00	111 29 49.00	X	
	MST066	*Ballard Creek* above Blackfoot River	42 48 56.30	111 30 07.32	X	
	MST067	*Ballard Creek* headwaters	42 49 23.79	111 29 36.31	X	
	MST069	*Short Creek* below Ballard Mine	42 49 11.23	111 29 19.75	X	TBD
	MST089	*Wooley Valley Creek*, below *North Fork Wooley Valley Creek*	42 49 28.70	111 26 19.40	X	
	MST090	*Wooley Valley Creek*, above *North Fork Wooley Valley Creek*	42 49 28.00	111 26 49.00	X	
	MST092	*North Fork Wooley Valley Creek* above *Wooley Valley Creek*	42 49 40.00	111 27 04.30	X	
	MST094	*Spring-fed trib. #1 of N. Fork Wooley Valley Cr.,* below Ballard Mine	42 49 56.00	111 28 10.00	X	
	MST095	*Spring-fed trib. #2 of N. Fork Wooley Valley Cr.,* below Ballard Mine	42 49 39.00	111 28 05.00	X	
	MST096	Tributary of North Fork Wooley Valley Creek, below Ballard Mine	42 49 30.00	111 27 45.00	X	
	MDS030	*Pit #2 Upper Dump Seep*	42 49 44.25	111 29 20.95	X	TBD
	MSG004	*Holmgren Spring*	42 49 16.75	111 28 16.04	X	TBD
	MSG005[f]	*Cattle Spring*	42 49 19.07	111 28 01.90	X	
	MSG006	*Southeast Spring*	42 49 41.43	111 27 51.34	X	
	MSG007	*South of Southeast Spring*	42 49 38.19	111 27 42.68	X	
Henry Mine	MST044	Immediately below Henry Mine (1997 #24)	42 53 50.60	111 29 24.80	X	TBD
	MST045	Little Blackfoot River above Henry Creek	42 54 10.70	111 29 30.10	X	TBD
	MST051	East Fork Long Valley Creek below Henry Mine	42 52 18.23	111 28 58.49	X	
	MST057	West Fork Lone Pine Creek above Lone Pine Creek	42 51 59.49	111 26 21.78	X	
	MST063	Strip Mine Creek below Henry Mine	42 52 01.70	111 27 03.40	X	
	MST226	Tributary to Lone Pine Creek	42 51 42.27	111 25 55.16	X	
	MST275	Tributary to Lone Pine Creek	42 51 56.33	111 25 04.24	X	TBD
	MDS034	Henry Mine, Dump Seep #3	111 29 23.87	42 53 46.90	X	TBD
Enoch Valley Mine	MST128	*Angus Creek* above Rasmussen Creek	42 51 08.00	111 22 32.00	X	
	MST131	*Rasmussen Creek* above Angus Creek	42 51 08.00	111 22 31.00	X	
	MST132	Angus Creek Above *No Name Creek* and below *Rasmussen Creek*	42 51 07.00	111 22 29.00	X	
	MST133	*Rasmussen Creek* below Enoch Valley Mine	42 51 48.00	111 23 50.00	X	
	MST136	*Rasmussen Creek* headwaters near *Enoch Valley Mine Shop Pond*	42 52 34.00	111 25 03.00	X	

TABLE 2
2014 LTM SURFACE WATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE

Mine	Station ID[a]	Feature Name[b]	Location[c]		Sample Schedule	
			Latitude	Longitude	Spring	Fall[d]
	MST143	*East Fork Rasmussen Creek* above *Rasmussen Creek*	42 51 31.70	111 23 01.40	X	
	MST144	*West Pond Creek headwaters*, below West Pond	42 52 16.07	111 24 18.66	X	TBD
	MST269	*East Fork Rasmussen Creek* headwaters	42 52 16.57	111 23 41.69	X	
	MST274	West Fork of Rasmussen Creek	42 51 31.00	111 23 34.00	X	TBD
	MDS025	West Dump Seep	42 52 13.00	111 24 11.00	X	TBD
	MDS026	South Dump Seep	42 51 54.20	111 23 36.27	X	TBD

MDS - Dump Seep
MSG - Spring
MST – Stream
TBD - To be determined

[a] Table does not include all available surface water monitoring locations at the P4 Sites, only those locations identified for continued monitoring

[b] Stream names in *italics* were assigned by either IMA or P4 Production as these streams are unnamed on USGS maps or, as far as is known, are unnamed by common usage of local inhabitants. The reason for this is that most such streams are small with intermittent or ephemeral flows.

[c] Location (GPS) coordinates use the NAD27 datum and are presented in ddd mm ss.ss format (degrees minutes seconds).

[d] Fall sampling program will be evaluated based on the recent year historical results and will follow the protocol set forth in the 2009 and 2010 Surface Water SAP.

Table 3
2014 Spring LTM Sample Tracker for Surface Water Stations
(Page 1 of 4)

					Lab Parameters - Analyte List						Field Parameters												
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd, Se (SW6020A)	Dissolved Ca, Mg, V (SW6010B/C)	Dissolved SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (ºC)	Air Temperature (ºC)	Discharge (ft^3/sec)	Date Sampled	GPS UTM Coordinates NAD27 datum in ddd mm ss.ss format (degrees minutes seconds)	
																						Latitude	Longitude
SWMDS025-U	MDS025	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMDS025-F	MDS025	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMDS026-U	MDS026	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMDS026-F	MDS026	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMDS030-1-U	MDS030	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMDS030-1-F	MDS030	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMDS030-2-U	MDS030	Water	Unfiltered	Duplicate	X				X		X	X	X	X	X	X	X	X	X	X			
SWMDS030-2-F	MDS030	Water	Filtered	Duplicate		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMDS034-U	MDS034	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMDS034-F	MDS034	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMSG004-U	MSG004	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMSG004-F	MSG004	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMSG004-U-MS	MSG004	Water	Unfiltered	MS	X				X		X	X	X	X	X	X	X	X	X	X			
SWMSG004-F-MS	MSG004	Water	Filtered	MS		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMSG004-U-MSD	MSG004	Water	Unfiltered	MSD	X				X		X	X	X	X	X	X	X	X	X	X			
SWMSG004-F-MSD	MSG004	Water	Filtered	MSD		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMSG005-U	MSG005	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMSG005-F	MSG005	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMSG006-U	MSG006	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMSG006-F	MSG006	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMSG007-U	MSG007	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMSG007-F	MSG007	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST019-U	MST019	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST019-F	MST019	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST020-U	MST020	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST020-F	MST020	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST044-U	MST044	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST044-F	MST044	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST045-1-U	MST045	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST045-1-F	MST045	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST045-2-U	MST045	Water	Unfiltered	Duplicate	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST045-2-F	MST045	Water	Filtered	Duplicate		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST050-U	MST050	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST050-F	MST050	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST051-U	MST051	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST051-F	MST051	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			

Table 3
2014 Spring LTM Sample Tracker for Surface Water Stations
(Page 2 of 4)

					Lab Parameters - Analyte List						Field Parameters												
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd, Se (SW6020A)	Dissolved Ca, Mg, V (SW6010B/C)	Dissolved SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (ºC)	Air Temperature (ºC)	Discharge (ft^3/sec)	Date Sampled	GPS UTM Coordinates NAD27 datum in ddd mm ss.ss format (degrees minutes seconds)	
SWMST057-U	MST057	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST057-F	MST057	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST063-U	MST063	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST063-F	MST063	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST063-U-MS	MST063	Water	Unfiltered	MS	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST063-F-MS	MST063	Water	Filtered	MS		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST063-U-MSD	MST063	Water	Unfiltered	MSD	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST063-F-MSD	MST063	Water	Filtered	MSD		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST066-U	MST066	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST066-F	MST066	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST067-U	MST067	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST067-F	MST067	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST069-U	MST069	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST069-F	MST069	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST089-U	MST089	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST089-F	MST089	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST089-U-MS	MST089	Water	Unfiltered	MS	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST089-F-MS	MST089	Water	Filtered	MS		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST089-U-MSD	MST089	Water	Unfiltered	MSD	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST089-F-MSD	MST089	Water	Filtered	MSD		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST090-U	MST090	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST090-F	MST090	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST092-U	MST092	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST092-F	MST092	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST094-U	MST094	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST094-F	MST094	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST095-U	MST095	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST095-F	MST095	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST096-U	MST096	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST096-F	MST096	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST128-U	MST128	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST128-F	MST128	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST131-U	MST131	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST131-F	MST131	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST132-1-U	MST132	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X			
SWMST132-1-F	MST132	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X			
SWMST132-2-U	MST132	Water	Unfiltered	Duplicate	X				X		X	X	X	X	X	X	X	X	X	X			

Table 3
2014 Spring LTM Sample Tracker for Surface Water Stations
(Page 3 of 4)

					Lab Parameters - Analyte List							Field Parameters												
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd, Se (SW6020A)	Dissolved Ca, Mg, V (SW6010B/C)	Dissolved SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)		Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (ºC)	Air Temperature (ºC)	Discharge (ft^3/sec)	Date Sampled	GPS UTM Coordinates NAD27 datum in ddd mm ss.ss format (degrees minutes seconds)	
SWMST132-2-F	MST132	Water	Filtered	Duplicate		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
SWMST133-U	MST133	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X			
SWMST133-F	MST133	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
SWMST136-U	MST136	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X			
SWMST136-F	MST136	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
SWMST143-U	MST143	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X			
SWMST143-F	MST143	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
SWMST144-U	MST144	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X			
SWMST144-F	MST144	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
SWMST226-U	MST226	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X			
SWMST226-F	MST226	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
SWMST269-U	MST269	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X			
SWMST269-F	MST269	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
SWMST274-U	MST274	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X			
SWMST274-F	MST274	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
SWMST275-U	MST275	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X			
SWMST275-F	MST275	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X			
ER-SW-01-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-01-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-02-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-02-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-03-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-03-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-04-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-04-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-05-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-05-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-06-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-06-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-07-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-07-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-08-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-08-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-09-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-09-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														
ER-SW-10-U	na	Water	Unfiltered	Equip Rinsate	X				X															
ER-SW-10-F	na	Water	Filtered	Equip Rinsate		X	X	X		X														

Table 3
2014 Spring LTM Sample Tracker for Surface Water Stations
(Page 4 of 4)

					Lab Parameters - Analyte List						Field Parameters												
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd, Se (SW6020A)	Dissolved Ca, Mg, V (SW6010B/C)	Dissolved SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)	Date Sampled	GPS UTM Coordinates NAD27 datum in ddd mm ss.ss format (degrees minutes seconds)	
ER-SW-11-U	na	Water	Unfiltered	Equip Rinsate	X				X														
ER-SW-11-F	na	Water	Filtered	Equip Rinsate		X	X	X		X													
ER-SW-12-U	na	Water	Unfiltered	Equip Rinsate	X				X														
ER-SW-12-F	na	Water	Filtered	Equip Rinsate		X	X	X		X													
ER-SW-13-U	na	Water	Unfiltered	Equip Rinsate	X				X														
ER-SW-13-F	na	Water	Filtered	Equip Rinsate		X	X	X		X													
ER-SW-14-U	na	Water	Unfiltered	Equip Rinsate	X				X														
ER-SW-14-F	na	Water	Filtered	Equip Rinsate		X	X	X		X													
B-SW-01-U	na	Water	Unfiltered	Source Water	X				X														
B-SW-01-F	na	Water	Filtered	Source Water		X	X	X		X													

Ca - Calcium	µS/cm	microsiemens per centimeter	°C	Degrees celsius
Cd - Cadmium	% sat	percent saturation	ft^3/sec	cubic feet per second
Mg - Magnesium	mg/L	Milligrams per liter		
Se - Selenium	mV	Millivolts		
SO4 - Sulfate	ftu	Formazin Turbidity Unit		
TDS - Total Dissolved Solids				
V - Validium				

B – source water blank sample, to be taken once per field effort
ER - equipment rinsate blank sample, to be taken once per field team per day, total ERs taken may not add up to what is accounted for here
GPS - global positioning system
ID - identification
QC - quality control
UTM - universal transverse mercator
na - not applicable
[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2013 would have a prefix of (1306) followed by the normal sample ID.

TABLE 4 2014 LTM GROUNDWATER MONITORING WELL AND BOREHOLE WELL LOCATIONS								
Mine	**Station ID**	**Station Description**	**Location**		**Well Install Year**	**Groundwater System Monitored Screened Interval (ft bgs)**	**Sample Schedule**	**Analyte List**
			Latitude	**Longitude**				
Ballard Mine	MBW006	Short Creek	42 49 04.15	111 29 25.80	2008	Alluvial 14-9	Spring	Primary*
	MBW009	Blackfoot River Road @ Monsanto Haul Road	42 49 12.96	111 29 48.71	2008	Alluvial 11-6	Spring	Primary
	MBW011	Ballard Creek	42 49 23.46	111 29 38.93	2008	Alluvial 15-10	Spring	Primary
	MBW027	Ballard, Western Deeper	42 50 02.23	111 29 54.34	2008	Alluvial 16-11	Spring	Primary
	MBW028	Torgesen	42 49 34.44	111 29 42.93	2008	Alluvial 21-16	Spring	Primary
	MBW032	Holmgren	42 49 33.92	111 28 11.14	2008	Alluvial 15-10	Spring	Primary
	MBW048	Wooley Valley Creek	42 50 03.76	111 27 56.21	2008	Alluvial 9-4	Spring	Primary
	MBW130	East of Ballard Mine, along Wooley Valley Creek	42 49 40.00	111 27 10.00	2009	Alluvial 25-20	Spring	Primary
	MBW131	Northeast of Ballard Mine, near MST093	42 50 24.00	111 28 33.00	2009	Alluvial 8-3	Spring	Primary
	MBW135	Southeast of Ballard Mine, across Blackfoot River Road	42 48 40.00	111 29 43.00	2009	Alluvial 20-15	Spring	Primary
	MMW006	South of West Ballard Pit; south of waste rock dumps	42 49 20.00	111 29 03.00	2007	Wells Formation 330-310	Spring	Primary
	MMW017	Northwest of Ballard Mine into Long Valley Creek alluvial flow field	42 49 59.60	111 29 47.40	2007	Alluvial 56-36	Spring	Primary
	MMW018	East of Ballard Mine in Wooley Valley alluvial flow field	42 49 39.40	111 28 04.50	2007	Alluvial/ Dinwoody Formation 33-18	Spring	Primary
	MMW020	East side of West Ballard Pit (MMP035); replacement of MMW001	42 49 36.40	111 29 03.30	2007	Wells Formation 408-388	Spring	Primary
	MMW021	West side of West Ballard Pit (MMP035); replacement of MMW002	42 49 35.60	111 29 23.90	2007	Wells Formation 250-230	Spring	Primary
	MMW029	East Ballard mine area in the vicinity of MMW018	42 49 37.78	111 28 08.74	2008	Dinwoody Formation 60-45	Spring	Primary
	MMW030	Along the southwestern portion of Ballard Mine in the vicinity of MMW016A	42 49 10.72	111 29 17.03	2008	Wells Formation 155-135	Spring	Primary
	MMW031	Along the western perimeter of Ballard Mine in the vicinity and north of MMW017	42 50 11.87	111 29 43.05	2008	Wells Formation 200-180	Spring	Primary
	MMW032	Adjacent to MWD084	42 50 09.30	111 28 21.80	2009	Dinwoody Formation65-55	Spring	Primary

TABLE 4

2014 LTM GROUNDWATER MONITORING WELL AND BOREHOLE WELL LOCATIONS

Mine	Station ID	Station Description	Location		Well Install Year	Groundwater System Monitored Screened Interval (ft bgs)	Sample Schedule	Analyte List
			Latitude	Longitude				
	MMW033	Deeper well nested with MMW029	42 49 35.30	111 2811.90	2009	Dinwoody Formation 150-130	Spring	Primary*
	MW-15A	West Ballard Mine near MST068	42 49 35.99	111 29 36.55	2006	Alluvial 40-30	Spring	Primary
	MW-16A	Southwest Ballard Mine near MST069	42 49 08.83	111 29 16.53	2006	Alluvial 30-20	Spring	Primary
Henry Mine	MBW152	North Henry Mine, along Little Blackfoot River	42 54 14.00	111 29 23.00	2009	Alluvial 15-10	Spring	Primary
	MMW010	Southeast of Center Henry Pit; near MPW023	42 52 22.30	111 27 51.30	2007	Alluvial 32-12	Spring	Primary
	MMW011	Northwest of Center Henry Pit; south of Little Blackfoot River	42 53 48.30	111 29 30.00	2007	Wells Formation 115-95	Spring	Primary
	MMW022	Northeast lobe of Henry Mine waste rock dump MWD086	42 53 09.20	111 28 18.30	2007	Dinwoody Formation 326-306	Spring	Primary
	MMW023	Henry Mine North Pit	42 54 20.50	111 30 27.50	2007	Wells Formation 357-352	Spring	Primary
	MMW028	Near the Little Blackfoot River northwest of MMW019	42 53 50.24	111 28 60.00	2008	Dinwoody Formation 96-76	Spring	Primary
Enoch Valley Mine	MBW085	Rasmussen Creek	42 51 55.52	111 24 04.12	2008	Alluvial 12.25-7.25	Spring	Primary
	MBW087	Rasmussen Road and Agrium Haul Road intersection	42 51 38.34	111 23 44.32	2008	Alluvial 12-7	Spring	Primary
	MBW099	Agrium Haul Road North	42 51 57.08	111 23 28.14	2008	Alluvial 29-24	Spring	Primary
	MBW107	Western Enoch Valley, East of fence	42 53 28.32	111 25 55.86	2008	Alluvial 40-35	Spring	Primary
	MBW112	Western Enoch Valley, west of fence	42 53 34.67	111 26 13.72	2008	Alluvial 18-13	Spring	Primary
	MMW007	South of EVM South Dump; near edge of dump footprint	42 51 48.50	111 23 34.40	2007	Alluvial/ Dinwoody Formation 90-70	Spring	Primary
	MMW009	Central North Dump (MWD091)	42 53 34.60	111 25 33.80	2007	Wells Formation 554-549	Spring	Primary
	MMW012	Northwest of EVM North Dump in Lone Pine Creek alluvial flow field	42 53 28.75	111 25 53.34	2007	Alluvial/ Dinwoody Formation 52-28	Spring	Primary
	MMW013	Southwest of EVM in Rasmussen Creek alluvial flow field	42 52 05.70	111 24 12.00	2007	Dinwoody Formation 35-25	Spring	Primary
	MMW024	Along the south end of Enoch Valley Mine, near MMW013	42 52 11.73	111 24 11.86	2008	Dinwoody Formation 200-180	Spring	Primary

TABLE 4

2014 LTM GROUNDWATER MONITORING WELL AND BOREHOLE WELL LOCATIONS

Mine	Station ID	Station Description	Location		Well Install Year	Groundwater System Monitored Screened Interval (ft bgs)	Sample Schedule	Analyte List
			Latitude	Longitude				
	MMW025	Along the south end of Enoch Valley Mine, near MMW007	42 51 49.16	111 23 31.95	2008	Dinwoody Formation 200-180	Spring	Primary*
	MMW026	Northeast of MPW006/MMW008	42 51 56.48	111 23 25.75	2008	Wells Formation 355-335	Spring	Primary
	MMW027	Near MMW012	42 53 28.97	111 25 53.50	2008	Dinwoody Formation 120-100	Spring	Primary
	MMW034	Deeper well nested with MMW013	42 52 09.10	111 24 14.80	2009	Dinwoody Formation 156-136	Spring	Primary
	MMW035	Deeper well nested with MMW027	42 53 29.50	111 25 54.30	2009	Dinwoody Formation 199 – 179	Spring	Primary
	MMW036	Well west of MMW027	42 53 26.70	111 26 05.60	2009	Basalt 135 – 115	Spring	Primary
	MMW037	Nested with MMW036	42 53 26.14	111 26 06.82	2010	Dinwoody 302 – 292	Spring	Primary

Notes:

MBW - Borehole Monitoring Well (direct-push pre-packed screen monitoring well)
MMW - Monitoring Well

* The primary analyte list is presented in Table 1 and includes analytes, fraction, and analytical methods for monitoring wells and direct push borehole wells.

Borehole Monitoring Wells (direct push) are differentiated from “regular or standard” monitoring wells based on their methods and means of completion. In general, the direct-push borehole monitoring wells have a smaller diameter and a shorter pre-packed screened interval than the regular monitoring wells.

Table 5
2014 Spring LTM Sample Tracker for Monitoring Wells and Direct Push Borehole Wells
(Page 1 of 4)

					Lab Parameters - Primary Analyte List[b]				Field Parameters											
Field Sample Identification[a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Mn, and Se (SW6020A)	Dissolved Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Water Elevation (ft amsl)	Date Sampled	GPS UTM Coordinates NAD27 datum in ddd mm ss.ss format (degrees minutes seconds)	
																			Latitude	Longitude
GWMBW006-U	MBW006	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW006-F	MBW006	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW009-U	MBW009	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW009-F	MBW009	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW011-U	MBW011	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW011-F	MBW011	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW027-U	MBW027	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW027-F	MBW027	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW028-U	MBW028	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW028-F	MBW028	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW032-1-U	MBW032	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW032-1-F	MBW032	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW032-2-U	MBW032	Water		Duplicate	X		X		X	X		X	X	X	X	X	X			
GWMBW032-2-F	MBW032	Water	X	Duplicate	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW048-U	MBW048	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW048-F	MBW048	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW085-U	MBW085	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW085-F	MBW085	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW087-1-U	MBW087	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW087-1-F	MBW087	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW099-U	MBW099	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW099-F	MBW099	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW107-U	MBW107	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW107-F	MBW107	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW112-U	MBW112	Water		Primary	TBD		TBD		X	X		X	X	X	X	X	X			
GWMBW112-F	MBW112	Water	X	Primary	TBD	TBD	TBD	TBD	X	X		X	X	X	X	X	X			
GWMBW130-U	MBW130	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW130-F	MBW130	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW131-U	MBW131	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW131-F	MBW131	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW135-U	MBW135	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW135-F	MBW135	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMBW152-U	MBW152	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMBW152-F	MBW152	Water	X	Primary	O	X	O	X	X	X		X	X	X	X	X	X			
GWMMW006-U	MMW006	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW006-F	MMW006	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			

Table 5
2014 Spring LTM Sample Tracker for Monitoring Wells and Direct Push Borehole Wells
(Page 2 of 4)

					Lab Parameters - Primary Analyte List[b]				Field Parameters											
Field Sample Identification[a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Mn, and Se (SW6020A)	Dissolved Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Water Elevation (ft amsl)	Date Sampled	GPS UTM Coordinates NAD27 datum in ddd mm ss.ss format (degrees minutes seconds)	
GWMMW007-U	MMW007	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW007-F	MMW007	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW007-U-MS	MMW007	Water		MS	X		X		X	X		X	X	X	X	X	X			
GWMMW007-F-MS	MMW007	Water	X	MS		X		X	X	X		X	X	X	X	X	X			
GWMMW007-U-MSD	MMW007	Water		MSD	X		X		X	X		X	X	X	X	X	X			
GWMMW007-F-MSD	MMW007	Water	X	MSD		X		X	X	X		X	X	X	X	X	X			
GWMMW009-U	MMW009	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW009-F	MMW009	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW010-U	MMW010	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW010-F	MMW010	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW011-U	MMW011	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW011-F	MMW011	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW012-U	MMW012	Water		Primary	TBD		TBD		X	X		X	X	X	X	X	X			
GWMMW012-F	MMW012	Water	X	Primary		TBD		TBD	X	X		X	X	X	X	X	X			
GWMMW013-U	MMW013	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW013-F	MMW013	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW017-U	MMW017	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW017-F	MMW017	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW018-U	MMW018	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW018-F	MMW018	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW018-U-MS	MMW018	Water		MS	X		X		X	X		X	X	X	X	X	X			
GWMMW018-F-MS	MMW018	Water	X	MS		X		X	X	X		X	X	X	X	X	X			
GWMMW018-U-MSD	MMW018	Water		MSD	X		X		X	X		X	X	X	X	X	X			
GWMMW018-F-MSD	MMW018	Water	X	MSD		X		X	X	X		X	X	X	X	X	X			
GWMMW020-U	MMW020	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW020-F	MMW020	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW021-U	MMW021	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW021-F	MMW021	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW022-U	MMW022	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW022-F	MMW022	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW023-U	MMW023	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW023-F	MMW023	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW024-U	MMW024	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW024-F	MMW024	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW025-U	MMW025	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW025-F	MMW025	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			

Table 5
2014 Spring LTM Sample Tracker for Monitoring Wells and Direct Push Borehole Wells
(Page 3 of 4)

					Lab Parameters - Primary Analyte List[b]				Field Parameters											
Field Sample Identification[a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Mn, and Se (SW6020A)	Dissolved Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Water Elevation (ft amsl)	Date Sampled	GPS UTM Coordinates NAD27 datum in ddd mm ss.ss format (degrees minutes seconds)	
GWMMW026-U	MMW026	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW026-F	MMW026	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW027-U	MMW027	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW027-F	MMW027	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW028-1-U	MMW028	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW028-1-F	MMW028	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW028-2-U	MMW028	Water		Duplicate	X		X		X	X		X	X	X	X	X	X			
GWMMW028-2-F	MMW028	Water	X	Duplicate		X		X	X	X		X	X	X	X	X	X			
GWMMW029-U	MMW029	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW029-F	MMW029	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW030-U	MMW030	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW030-F	MMW030	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW031-U	MMW031	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW031-F	MMW031	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW032-U	MMW032	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW032-F	MMW032	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW033-U	MMW033	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW033-F	MMW033	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW034-1-U	MMW034	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW034-1-F	MMW034	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW034-2-U	MMW034	Water		Duplicate	X		X		X	X		X	X	X	X	X	X			
GWMMW034-2-F	MMW034	Water	X	Duplicate		X		X	X	X		X	X	X	X	X	X			
GWMMW035-U	MMW035	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW035-F	MMW035	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW036-U	MMW036	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW036-F	MMW036	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW036-U-MS	MMW036	Water		MS	X		X		X	X		X	X	X	X	X	X			
GWMMW036-F-MS	MMW036	Water	X	MS		X		X	X	X		X	X	X	X	X	X			
GWMMW036-U-MSD	MMW036	Water		MSD	X		X		X	X		X	X	X	X	X	X			
GWMMW036-F-MSD	MMW036	Water	X	MSD		X		X	X	X		X	X	X	X	X	X			
GWMMW037-1-U	MMW037	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMMW037-1-F	MMW037	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			
GWMMW037-2-U	MMW037	Water		Duplicate	X		X		X	X		X	X	X	X	X	X			
GWMMW037-2-F	MMW037	Water	X	Duplicate		X		X	X	X		X	X	X	X	X	X			
GWMW-15A-U	MW-15A	Water		Primary	X		X		X	X		X	X	X	X	X	X			
GWMW-15A-F	MW-15A	Water	X	Primary		X		X	X	X		X	X	X	X	X	X			

Table 5
2014 Spring LTM Sample Tracker for Monitoring Wells and Direct Push Borehole Wells
(Page 4 of 4)

					Lab Parameters - Primary Analyte List[b]					Field Parameters											
Field Sample Identification[a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Mn, and Se (SW6020A)	Dissolved Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Water Elevation (ft amsl)	Date Sampled	GPS UTM Coordinates NAD27 datum in ddd mm ss.ss format (degrees minutes seconds)	
GWMW-16A-U	MW-16A	Water		Primary	X		X			X	X		X	X	X	X	X	X			
GWMW-16A-F	MW-16A	Water	X	Primary		X		X		X	X		X	X	X	X	X	X			
B-GW-01-U	na	Water		B	X		X														
B-GW-01-F	na	Water	X	B		X		X													

Cd - Cadmium	µS/cm	microsiemens per centimeter			
Mn - Manganese	% sat	percent saturation	°C	Degrees celsius	
Se - Selenium	mg/L	Milligrams per liter	ft^3/sec	cubic feet per second	
SO_4 - Sulfate	mV	Millivolts	ftu	Formazin Turbidity Unit	
TDS - Total Dissolved Solids					

O - Direct-push monitoring wells will be sampled for total and dissolved fraction when the turbidity is less than 5 NTU.

If the turbidity is greater than 5 NTU, then the sample will be analyzed for the dissolved fraction only.

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

GPS - global positioning system

ID - identification

QC - quality control

TBD - to be determined, analyte list for MBW112 and MMW012 will be determined in consult with A/Ts if water is encountered and the well recovers following purging

UTM - universal transverse mercator

na - not applicable

Primary QC sample indicates that it is the first samples collected.

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 201
would have a prefix of (1306) followed by the normal sample ID

[b] The primary analyte list is presented in Table 1

MBW - Borehole Monitoring Well (direct-push pre-packed screen monitoring well

MMW - Monitoring Well

Borehole Monitoring Wells (direct push) are differentiated from "regular or standard" monitoring wells based on their methods and means of completion

In general, they have a smaller diameter and a shorter pre-packed screened interval than the regular wells

ATTACHMENT 1
2009 AND 2010 SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN


Looking northwest over livestock drinking troughs at MSG001 near Enoch Valley mine

P4 PRODUCTION

2009 AND 2010 SURFACE WATER MONITORING SAMPLING AND ANALYSIS PLAN

FINAL
Revision 2

Prepared by
MWH
2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

May 2009

May 22, 2009

Mr. Michael Rowe
444 Hospital Way, #300
Pocatello, ID 83201

Re: Final *2009 and 2010 Surface Water Monitoring Sampling and Plan* – Revision 2 and Response to Agencies/Tribes Comments on *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan*, 5 May 2009.

Dear Mr. Rowe:

MWH is submitting the attached *Final 2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan* (Plan) on behalf of P4 Productions. The Plan includes the response to Agencies and Tribes (A/T) comments on the 22 April 2009 Revision 1 draft in Appendix C of the Plan. In the comment response, each A/T comment requiring a response is repeated and then followed by a response. The comment response to the previous Revision 0 draft is also contained in Appendix C. For this submittal we are providing the complete Plan electronically on the ftp site, and replacement pages and covers where changes were made.

We have completed the spring 2009 surface water monitoring program and thank you for your review and contingent approval of this document. Please feel free to contact me if you have any questions or need any additional information.

Respectfully,
MWH Americas, Inc.

Cary L. Foulk
Supervising Geologist/Geochemist

cc:
Hard copy, CD and electronic version:
Mike Rowe, Doug Tanner*,
Bruce Olenick*, Cindy Steed*, IDEQ
Gerry Winter, IDEQ
USFS Soda Spring District Office
Mary Kauffman, USFS
Jason Sturm, BLM
Kelly Wright, Shoshone-Bannock Tribes
Cary Foulk, MWH
Tim Mosko, CH2M Hill
Sandi Arena, USFWS
Lorraine Edmond, USEPA
Dave Tomten, USEPA
Allen Ruberry, IDL
Bill Wiley, BIA
Bob Geddes, Monsanto
Barry Koch, Monsanto
Dave Farnsworth, Monsanto
Randy White, Monsanto
Dale Ralston, RHS

Electronic version only:
Joe Wallace, USEPA
Jim McCulloch, Monsanto
Mike Vice, Monsanto
Patrick McCullough, Monsanto
Don Wind, Monsanto
Paul Stenhouse, Monsanto

*These people share hard copies with the main recipient on the list. They are also included on the email distribution.

Attachment – *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan,* Revision 2, May 2009 and Response to Agencies/Tribes Comments.

2353 130th Ave NE, Suite 200
Bellevue, Washington
98005 USA
Tel: 425 896 6900
Fax: 425 602 4020
BUILDING A BETTER WORLD

2009 & 2010 SURFACE WATER MONITORING

SAMPLING AND ANALYSIS PLAN

FINAL
Revision 2

May 22, 2009

TABLE OF CONTENTS

1.0 INTRODUCTION **1-1**
2.0 DATA QUALITY OBJECTIVES **2-1**
3.0 PLAN RATIONALE SUMMARY **3-1**
3.1 1ST PHASE—SPATIAL RELEVANCE 3-1
3.2 2ND PHASE — ANALYTICAL SCREENING 3-6
3.2.1 Screening Hierarchy 3-6
3.2.2 Analyte Selection 3-13
3.2.3 Seasonal Sampling Evaluation 3-14
4.0 REFERENCES **4-1**

LIST OF FIGURES

Figure 1 Spring 2008 Selenium Spatial Wire Diagram with 2009 Sampling Locations

LIST OF TABLES

Table 2-1 Surface Water Monitoring DQOs
Table 3-1 2009 and 2010 Surface Water Monitoring Locations Summary of Selenium Concentrations
Table 3-2 Achievable Laboratory Limits and Applicable Project Screening Values Surface Water and Groundwater
Table 3-3 Summary of Maximum Factors of Exceedances for Retained Surface Water Monitoring Stations
Table 3-4 Summary of Sampling Events and Exceedances for Retained Surface Water Monitoring Stations
Table 3-5 Summary of Selenium and Sulfate Concentrations and Seasonal Sampling Evaluation

APPENDICES

Appendix A Field Sampling Plan
Appendix B Health and Safety Plan
Appendix C Document Comments and Responses

ACRONYMS AND ABBREVIATIONS

A/T	Agencies and Tribes
Al	Aluminum
Ca	Calcium
$CaCO_3$	Calcium carbonate
Cd	Cadmium
Cl	Chloride
COPC	Contaminant of Potential Concern
Cr	Chromium
DQOs	Data Quality Objectives
e.g.	*exempli gratia* (Latin, for example)
EE/CA	Engineering Evaluation/Cost Analysis
Fe	Iron
FSP	Field Sampling Plan
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
i.e.	*id est* (Latin, that is to say; in other words)
K	Potassium
mg/L	Milligrams per Liter
Mg	Magnesium
Mn	Manganese
MWH	MWH, Inc. (formerly Montgomery Watson Harza, Inc.)
Na	Sodium
Ni	Nickel
P4	P4 Production, L.L.C.
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RA	Risk Assessment
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
Se	Selenium
SO_4	Sulfate
SOP	Standard Operating Procedure
V	Vanadium
Zn	Zinc

1.0 INTRODUCTION

This document presents the relevant component documents for a Sampling and Analysis Plan (SAP) for the 2009 and 2010 surface water monitoring program at the P4 Production, L.L.C. (P4) mines near Soda Springs, Idaho. The mines include the inactive properties of Ballard, Henry, and Enoch Valley mines, collectively referred to as the Sites. The sampling program presented in this SAP was specifically requested by the Agencies and Tribes (A/T) in an email to P4 dated January 16, 2009 (IDEQ, 2009). This sampling and analysis plan is being submitted as a deliverable under the Consent Order/Administrative Order on Consent for the Performance of Site Investigations and Engineering Evaluations/Cost Analysis (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho (08/20/03), EPA Docket No. CERCLA-10-2003-0117.

The objective of previous surface water monitoring conducted at the sites (2004-2008) was to support characterization of the nature and extent of impacts to water quality associated with releases to surface water from potential sources at the Sites. P4 and the A/T now believe that there is adequate surface water data to support the development of a site investigation (SI) report or remedial investigation (RI) report, and to support baseline risk assessment. However, the A/T in their January 2009 correspondence identified the concern that a significant time gap in the surface water monitoring data set could occur in 2009 and 2010 during which time additional groundwater characterization will occur. In addition, the A/T believe that a continuous record of conditions will provide a more effective evaluation of future remedy effectiveness and allow for a greater understanding of potential long-term trends. The purpose of this plan is to define the network of relevant surface water stations and analytical parameters for an interim-term monitoring plan that will provide an annual assessment of surface water conditions downstream of potential sources associated with the Sites. The surface water data collected under this plan will also support the ongoing groundwater characterization and refinement of the hydrogeologic conceptual models of the Sites.

The components of this SAP include the field sampling plan (FSP), quality assurance project plan (QAPP), and health and safety plan (HSP). The FSP and HSP are included in Appendix A and B, respectively. The QAPP, which is not modified, is included by reference. In addition, as it is a key part of the project planning process, the data quality objectives (DQOs) are presented in Section 2.0.

While the SAP and FSP components are prepared as complete documents, it needs to be recognized that this continued surface water monitoring is part of the overall characterization of the Sites. Therefore, the larger workplan and SAP components are not repeated herein (i.e., an abbreviated SAP is presented). For complete background on the overall characterization of the Sites the following overall work plan documents should be referenced:

- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan—Final* (MWH, 2004a)
- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Project Field Sampling Plan—Final* (MWH, 2004b)
- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Field Sampling Plan—Final* (MWH, 2004e)
- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Quality Assurance Plan—Final* (MWH, 2004c)
- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Health and Safety Plan—Final* (MWH, 2004d)
- *Quality Assurance Project Plan Addendum Program Quality Assurance Plan - Final* (MWH, 2009) (*Final QAPP Addendum*)

For the 2009 and 2010 surface water monitoring program a new FSP and HSP has been prepared to incorporate refined approaches to the continued monitoring of surface water. In addition, instead of creating a new QAPP for this SAP, it is included by reference to the *Final QAPP Addendum* (MWH, 2009).

2.0 DATA QUALITY OBJECTIVES

The DQOs discussed in this section were used to guide the development of the sampling program. They identify the objectives and quality of data that must be obtained to perform continued surface water monitoring to support the decision making process related to the current engineering evaluation/cost analysis (EE/CA) program. (This program is transitioning to a remedial investigation/feasibility study (RI/FS) program.)

The DQOs are consistent with EPA guidance (USEPA, 2006) and apply the following seven-step process:

1. State the problem
2. Identify the goals of the study
3. Identify information inputs
4. Define the boundaries of the study
5. Develop the analytic approach
6. Specify performance or acceptance criteria
7. Develop the plan for obtaining data

DQOs have been specifically developed to guide the screening and selection of the surface water monitoring stations and analytes, which are the most substantial modifications to the surface water program. Within these, the principal study question (from Step 2) has a corresponding statement, as appropriate, in each of the remaining DQO steps. Outputs are given in each step and follow the 2006 DQO guidance (USEPA, 2006).

Each step of the DQO Process defines criteria that will be used to establish the final data collection design. The first five steps are primarily focused on identifying qualitative criteria, such as:

- the nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated;
- the decisions or estimates that need to be made and the order of priority for resolving them;
- the type of data needed; and
- an analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings (USEPA, 2006).

The sixth step establishes acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data. For this surface water monitoring program, the data are primarily collected for the measurement of analyte levels downgradient of potential P4 sources areas, and as such, the uncertainty in the data will be estimated and evaluated once collected. Current EPA-approved methods will be used for estimation of the level of uncertainty associated with the data.

In the seventh step of the DQO Process, a data collection design is developed that will generate data meeting the quantitative and qualitative criteria specified at the end of Step 6. The output from this step is largely contained in the FSP.

Two key factors that need to be considered in the DQO process are the conceptual model, for helping formulate the problem statements (DQO Step 1), and in this case, the facility map for identifying the spatial bounds of the program. The conceptual model is presented here to support the DQOs detailed in Table 2-1, *Surface Water Monitoring DQOs*. The facility map is included in the FSP.

The primary components of the conceptual model that support the DQOs are summarized as follows for surface water:

- Source – Contaminants of potential concern (COPCs) present in interburden and overburden rocks deposited in waste rock dumps, but possibly present in mine pits and other facilities that is able to enter surface water bodies due to seeps or runoff.

- Release mechanisms – Exposure to air and water results in mobilization of COPCs from increased surface area; precipitation may leach and mobilize COPCs primarily during spring runoff to receiving surface water bodies.

- Exposure pathways – Primary exposure through ingestion of COPCs in surface water.

- Receptors – Livestock, wildlife, or human ingestion of surface water with elevated COPC levels in surface water bodies.

These conceptual model components will be re-evaluated, refined, and verified as the project moves into risk assessment.

TABLE 2-1 SURFACE WATER MONITORING DATA QAULITY OBJECTIVES	
Step 1 - State the Problem	Historical mining operations at the Sites have resulted in mine waste materials being potential sources of selenium and other constituents to the environment. In general, the predominant mobilization mechanism for COPCs from these potential source areas occur during the spring runoff via surface water and shallow groundwater transport of dissolved constituents. P4 and the A/T's now believe there is adequate and extensive surface water data to support the development of a site investigation (SI) report or remedial investigation (RI) report, and to support baseline risk assessment. However, there is concern that a significant time gap in the surface water monitoring data set could occur in 2009 and 2010 during which time additional groundwater characterization will occur. Continued surface water monitoring downgradient of potential P4 sources is needed to provide an annual baseline record of conditions, both spatially and temporally, in order to more effectively evaluate potential future remedies' effectiveness and evaluate long-term trends. In addition, the surface water monitoring provides beneficial information regarding the fate and transport of dissolved constituents in the shallow alluvial groundwater, which will assist in refinement of the hydrogeologic conceptual models of the Sites. The primary components of the conceptual model that support the DQOs are summarized as follows for surface water: • Source – COPCs present in interburden and overburden rocks deposited in waste rock dumps, but possibly present in mine pits and other facilities that is able to enter surface water bodies due to seeps or runoff. • Release mechanisms – Exposure to air and water results in mobilization of COPCs from increased surface area; precipitation may leach and mobilize COPCs primarily during spring runoff to receiving surface water bodies. • Exposure pathways – Primary exposure through ingestion of COPCs in surface water. • Receptors – Livestock, wildlife, or human ingestion of surface water with elevated COPC levels in surface water bodies. The planning team, decision makers and principal data users include P4 and the A/T.
Step 2 – Identify the Goals of the Study	<u>Principal Study Question #1</u> Are temporal trends in surface water quality associated with potential P4 sources being adequately monitored by the monitoring station network?

TABLE 2-1 SURFACE WATER MONITORING DATA QAULITY OBJECTIVES	
	<u>Alternative actions:</u> 1. Evaluation indicates that the monitoring network can be optimized and the number of downgradient stations and/or analytes adjusted for future interim surface water monitoring. Data will be forwarded to the RI and risk assessment (RA). 2. No Action - station data and analyte list are of adequate quality, quantity, and in proper locations to characterize potential P4 source areas. Data will be forwarded to the RI and RA. <u>Decision statement:</u> Determine whether monitoring stations and analytes allow for sufficient characterization of changes in upgradient P4 sources and will allow development of a baseline for effectiveness monitoring of potential future remedies. If not, modify the number, analyte list, and/or locations of the monitoring stations sampled; otherwise, the existing stations and analyte list will continue to be sampled. <u>Principal Study Question #2</u> Are temporal trends in surface water quality associated with changes in alluvial groundwater quality and vice versa? <u>Alternative actions:</u> 1. Monitor the temporal trends in surface water and alluvial groundwater during similar times of the year as specified in the Surface Water Sampling and Analysis Plan and the Groundwater Sampling and Analysis Plan. 2. No Action - station data and analyte list are of adequate quality, quantity, and in proper locations to determine the effects of changes in groundwater and surface water quality. Data will be forwarded to the RI and RA. <u>Decision statement:</u> Determine what effect temporal changes in groundwater quality have on surface water quality, and vice versa. Modify the number, analyte list, and/or locations of the monitoring stations sampled in order to determine the potential effect these changes may have on each system; otherwise, the existing stations and analyte list will continue to be sampled.
Step 3 – Identify Information Inputs	The information inputs for the decision process include the following items that may exist or will need to be created. • list of analytes • current conceptual site models • existing facilities investigation information to be updated as needed (inventory and spatial delineation of potential source areas)

TABLE 2-1 SURFACE WATER MONITORING DATA QAULITY OBJECTIVES	
	• sample location maps (contained in FSP) • historic surface water and groundwater data (use of existing data will be dependent upon evaluations of data usability); data will be analyzed with appropriate methods for determining inorganic concentrations with detection limits suitable for comparison to risk-based screening levels • existing site characterization surface water quality sampling and analysis plans and procedures • risk-based screening benchmarks for analytes
Step 4 – Define the Boundaries of the Study	<u>Population of Interest:</u> Metals/metalloids and general water quality parameters in surface water <u>Spatial boundaries:</u> Surface water monitoring locations downgradient of potential source areas at Ballard, Henry, and Enoch Valley mine areas <u>Vertical boundary:</u> Mid-depth of the river or stream at surface water monitoring locations <u>Temporal boundary:</u> Surface water sample collection is planned for spring 2009 and 2010 during the peak flow (i.e., peak potential loading) for all proposed stations and for fall 2009 and 2010 for those stations that have higher historical selenium and sulfate concentrations in the fall. <u>Scale of Decision Making:</u> Spatially-relevant surface water monitoring locations from each sampling event <u>Practical Constraints</u> Sampling to occur during peak flow in May

TABLE 2-1 SURFACE WATER MONITORING DATA QAULITY OBJECTIVES	
Step 5 – Develop the Analytic Approach	<u>Principal Study Question #1</u> If a monitoring station and/or analyte are not required to evaluate potential impacts to surface water from potential upgradient P4 sources, then the need for the monitoring points and/or analytical parameters will be evaluated. If the proposed monitoring stations and/or analytes are not sufficient to determine baseline conditions for effectiveness monitoring, then the need for additional monitoring points and/or analytical parameters will be evaluated. Otherwise, the proposed locations and analytes will be considered adequate for the intended purpose of establishing baseline for effectiveness monitoring of potential future remedies. <u>Principal Study Question #2</u> If a monitoring station and/or analyte are not required to evaluate potential relationships between surface water and alluvial groundwater, then the need for the monitoring points and/or analytical parameters will be evaluated. If the proposed monitoring stations and/or analytes are not sufficient to evaluate the relationship between surface water and alluvial groundwater, then the need for additional monitoring points and/or analytical parameters will be evaluated. Otherwise, the proposed locations and analytes will be considered adequate for the intended purpose of evaluating the relationship between surface water and alluvial groundwater.
Step 6 – Specify Performance or Acceptance Criteria	A surface water sampling station located downstream of a potential P4 source area solely characterizing potential P4 surface water quality impacts will be retained for effectiveness monitoring. Analytical parameters will be compared to the applicable surface water quality risk-based screening level. The precision, accuracy, representativeness, comparability, and completeness criteria and the minimum detection limits will be used to evaluate the usability of analytical data in making decisions about potential impacts to surface water bodies downgradient of potential source areas from P4 mine related activities and at a minimum will help ensure that data collected for the interim monitoring will be of comparable quality when compared to the 2004-2008 site characterization data. Measurement errors will be minimized by implementing standard operating procedures for the sample collection, handling, preparation and analysis methods. All data must meet approved usability as defined in the *Final QAPP Addendum* (MWH, 2009).

TABLE 2-1 SURFACE WATER MONITORING DATA QAULITY OBJECTIVES	
Step 7 – Develop the Plan for Obtaining Data	The existing surface water data were reviewed as part of the preparation of this SAP. The sampling rationale and design, based on existing data, is presented in Section 3.0 of this SAP. The sampling design included screening of existing spatially-relevant surface water stations as well as evaluation of analytes that exceed applicable surface water quality risk-based standards. The sampling design will be further evaluated if surface water monitoring suggests that the proposed locations and analytes are not sufficient to determine the baseline conditions for effectiveness monitoring. The field methods and quality assurance requirements are presented in the FSP located in Appendix A.

3.0 PLAN RATIONALE SUMMARY

The purpose of this plan is to identify a network of surface water monitoring stations whose water quality is solely impacted by potential P4 sources and to identify an applicable analyte list. Therefore, only those locations and analytes from past monitoring events were considered for relevance. Monitoring changes in water quality from potential P4 sources for any future remediation is only effective where P4 can isolate changes in water quality that are direct impacts from potential P4 sources. Monitoring shared drainage networks offers no concrete information as to the effectiveness of any future remediation because the water quality at that location may still be impaired due to non-P4 mining activities. The selection of those spatially relevant locations that monitor surface water quality changes resulting from potential P4 sources was considered when selecting locations.

The rationale for keeping or discarding surface water stations for the 2009 and 2010 monitoring program was a two-phased approach. The first phase evaluated spatial relevance of past surface water monitoring stations, while the second phase reviewed the water quality against the fall 2008 analyte list at those spatially relevant surface water monitoring stations to determine an applicable analyte list.

3.1 1ST PHASE—SPATIAL RELEVANCE

The first phase screened the surface water station list based on spatial relevance to P4 potential source areas. For the purpose of 2009 and 2010 monitoring, those surface water locations that may only be impacted by sources at potential P4 Sites are most relevant for determining P4 mine influence on water quality. Surface water stations that duplicated efforts (i.e., multiple locations on the Blackfoot River that do not solely characterize possible P4 mining impacts) or were located on drainages well above or below P4 inputs to shared systems (i.e., streams where multiple mining companies may impact surface water quality) were not retained. These spatially relevant stations are highlighted on Figure 1, *Spring 2008 Selenium Spatial Wire Diagram with 2009 Sampling Locations*.

Surface water monitoring stations that were not spatially relevant represent locations where water quality changes may not be solely attributable to P4's past mining activities. Where drainages may exhibit water quality representing potential impacts from other mining operations, P4 will sample above and below the confluence with P4's drainages originating from past mining operations. Doing so represents upstream conditions prior to P4's potential water quality impacts flowing into a shared drainage.

Examples of contaminant loading into various water features in the P4 site investigation area that may not be solely be attributable to P4 include Angus Creek (Wooley Valley Mine, Enoch Valley

Mine, and Rasmussen Ridge Mine) and the Blackfoot River (Wooley Valley Mine, Rasmussen Ridge Mine, Enoch Valley Mine, North Maybe Mine, South Maybe Mine, Lanes Creek Mine, Dry Valley Mine, Mountain Fuel Mine, Champ Mine, Ballard Mine, and Conda Mine).

Additional surface water locations that were not retained include stock ponds, all background stations, and dump seeps and springs. P4 has sampled background surface water quality on numerous occasions and has a reliable data set to characterize background water quality. P4 has sampled stock ponds numerous times at their three mine sites and understands the water quality from these sources. Springs and seeps that do not leave a mine site and have no surface hydraulic communication with continuously flowing waters were also not retained due to their lack of contribution to the Blackfoot River watershed. P4 has sampled springs and seeps at their historic mine sites and understands the water quality from these sources. However, some headwater stream locations (i.e., surface expressions of groundwater) were included in the 2009 and 2010 surface water monitoring plan. It is also recognized that surface water locations as well as spring and seep locations can provide data that assist in refinement of the hydrogeologic conceptual models of the Sites. Therefore, some spring and seep locations as well as groundwater monitoring wells that provide information for the ongoing phased groundwater characterization will continue to be monitored. This groundwater monitoring will be outlined in a separate sampling and analysis plan.

The surface water monitoring stations that were retained from the first phase focused on existing monitoring stations that characterize water quality as it is before and after historic P4 mining activities where surface water features exist. No new stations were identified as part of this effort. Table 3-1, *2009 and 2010 Surface Water Monitoring Locations Summary of Selenium Concentrations*, below, lists the 25 stations that were retained for 2009 and 2010 monitoring based on P4's evaluation of spatial relevance.

At Ballard Mine, there are five spatially relevant surface water features in the immediate vicinity of the mine. These are Long Valley Creek, Ballard Creek, Short Creek, and the north fork and main stem of Wooley Valley Creek. Also, two locations on the Blackfoot River above and below the confluence with Ballard Creek were retained.

At Henry Mine, there are four spatially relevant surface water features in the immediate vicinity of the mine. Incidentally, all surface water features listed eventually enter the Little Blackfoot River. These are Strip Mine Creek, Long Valley Creek, Lone Pine Creek, and the Little Blackfoot River before and after it passes through the northern portion of the mine.

At Enoch Valley Mine, there are three spatially relevant surface water features in the immediate vicinity of the mine area. Most of these drainages enter Angus Creek. These are Enoch Valley Mine West Dump Seep, Rasmussen Creek, and the East Fork Rasmussen Creek. Additionally, Angus Creek is included above and below the Rasmussen Creek confluence.

In the past, P4 has sampled numerous stations (approximately 80—100+) during spring and fall sampling events. Many of these locations were sited longitudinally on the same surface water features. Examples of this include the Blackfoot River, Angus Creek, Wooley Valley Creek, and the Little Blackfoot River. These duplicative locations that do not solely and directly characterize P4 chemical transport were not retained as spatially relevant to P4's mine-specific investigation. The locations that were retained are those locations that P4 believes are directly attributable to potential P4 source material and characterize P4 influenced waters before and after confluences with other drainages from nearby mine sites. These can be used to represent upstream conditions when sited above P4 confluences with other potentially impacted drainages. The water quality at potentially impacted locations upstream of P4's mine influence are not attributable to P4 and are those which P4 has no contribution.

TABLE 3-1
2009 AND 2010 SURFACE WATER MONITORING LOCATIONS
SUMMARY OF SELENIUM CONCENTRATIONS

Mine	Feature Name	Station ID	Sept 1997	May 1998	Sept 1998	May 1999	Sept 1999	May 2000	May 2001	May 2002	July 2002	Sept 2002	Nov 2002	Jan 2003	Mar 2003	April2003	May 2003	June 2003	July 2003	May 2004	Sept 2004	May 2006	May 2007	Sept 2007	May 2008	Sept 2008
Ballard Mine	Blackfoot River below Ballard Creek	MST019				0.0092	0.00041	0.0038		0.0070	0.0020	0.00038	-0.00075	0.00023	0.00057	0.0020	0.0030	0.00033	0.00023	0.0030		0.0080	0.0040	-0.00024	0.0040	0.0017
	Blackfoot River below State Land Creek	MST020		0.0068	0.000994	0.0081	0.0016	0.0055		0.0060		0.00044								0.0020		0.0070	0.0040	-0.00013	0.0050	0.0013
	Long Valley Creek below Ballard Mine	MST050								0.0020	0.0010	Dry	Dry	Dry	Dry	-0.00028	-0.00049	0.00021	0.00069	0.00033		0.00076	-0.00017	0.00087	0.00022	0.0025
	Ballard Creek above Blackfoot River	MST066								0.029		Dry								0.0010	Dry	0.046	0.023	0.00071	0.019	Dry
	Ballard Creek headwaters	MST067[1]								0.13	Dry	Dry	Dry	Dry	Dry	0.15	0.052	Dry	Dry	0.029	Dry	0.58	0.022	Dry	0.41	Dry
	Short Creek below Ballard Mine	MST069[1]								0.61	0.49	0.27	0.55	Dry	Dry	0.58	0.47	0.51	0.51	0.60	0.48	0.42	1.1	0.034	0.87	1.2
	Wooley Valley Creek, below North Fork Wooley Valley Creek	MST089								0.0020	Dry	Dry	Dry	Dry	Dry	0.010	0.00004	Dry	Dry	0.0010	Dry	0.025	-0.00005	Dry	0.0040	Dry
	Wooley Valley Creek, above North Fork Wooley Valley Creek	MST090								0.00010										0.0010			-0.00099	Dry	0.00019	Dry
	North Fork Wooley Valley Creek above Wooley Valley Creek	MST092								0.015		Dry								0.0060	Dry	0.044	-0.00057	Dry	0.0070	Dry
	North Fork Wooley Valley Creek above Ballard Mine	MST093[1]								0.0010		Dry								0.00091	Dry	-0.00075	-0.0023	Dry	0.0010	Dry
	Spring-fed trib. #1 of N. Fork Wooley Valley Cr., below Ballard Mine	MST094[1]					Dry			0.021	Dry	Dry	Dry		Dry	0.0020	Dry	Dry	Dry	0.023	Dry	0.0020	-0.0019	Dry	0.0020	Dry
	Spring-fed trib. #2 of N. Fork Wooley Valley Cr., below Ballard Mine	MST095[1]					Dry	0.047		0.16	Dry	Dry	Dry		Dry	0.22	0.080	Dry	Dry	0.059	Dry	0.39	0.073	Dry	0.23	Dry
Henry Mine	Immediately below Henry Mine (1997 #24)	MST044	0.0011	-0.00012	0.00078					0.0010										-0.00035			-0.00018	0.046	0.00020	0.0012
	Little Blackfoot River above Henry Creek	MST045	0.00081							0.0020										0.00008			0.00033	-0.00035	0.00004	0.0012
	East Fork Long Valley Creek below Henry Mine	MST051								Dry		Dry								Dry	Dry	Dry	Dry	Dry	Dry	Dry
	West Fork Lone Pine Creek above Lone Pine Creek	MST057								0.0070	0.0020	-0.00028	0.00024	0.0010	0.0010	0.0060	0.0020	0.0020	0.0020	0.0020	Dry	0.012	0.0060	0.0030	0.0090	0.0045
	Strip Mine Creek below Henry Mine	MST063								0.00010		Dry								0.0020		0.0070	0.0050	Dry	Dry	Dry

TABLE 3-1
2009 AND 2010 SURFACE WATER MONITORING LOCATIONS
SUMMARY OF SELENIUM CONCENTRATIONS

Mine	Feature Name	Station ID	Sept 1997	May 1998	Sept 1998	May 1999	Sept 1999	May 2000	May 2001	May 2002	July 2002	Sept 2002	Nov 2002	Jan 2003	Mar 2003	April2003	May 2003	June 2003	July 2003	May 2004	Sept 2004	May 2006	May 2007	Sept 2007	May 2008	Sept 2008
Enoch Valley Mine	Enoch Valley Mine West Dump Seep	MDS025[1]							0.0026	0.00060		Dry								0.016		1.7	0.056	Dry	Dry	Dry
	Angus Creek above Rasmussen Creek	MST128								0.00040		-0.00059								0.0010		0.0040	0.00046	-0.00027	0.0050	0.00074
	Rasmussen Creek above Angus Creek	MST131		0.0013	0.0010					0.0010	-0.0036	-0.00081	Frozen	0.00052	0.0010	0.0020	0.00013	0.00091	0.00020	0.0020		0.0050	0.0020	0.0020	0.0020	0.0022
	Angus Creek Above No Name Creek and below Rasmussen Creek	MST132		0.0014	0.00072					0.00050		-0.00034								-0.00004		0.0040	0.00088	0.00038	0.0040	0.0013
	Rasmussen Creek below Enoch Valley Mine	MST133	0.0013				0.0020	0.0019		0.0010		Dry								0.0040	Dry	0.0070	0.0010	Dry	0.00092	Dry
	Rasmussen Creek headwaters near Enoch Valley Mine Shop Pond	MST136[1]								0.014	Dry	Dry	Dry	Dry	Dry	0.039	0.0070	Dry	Dry	0.016	Dry	0.019	Dry	Dry	0.021	Dry
	East Fork Rasmussen Creek above Rasmussen Creek	MST143					Dry	0.0011		0.00030		Dry								-0.00015		-0.00043	0.00005	Dry	0.0030	0.0026
	East Fork Rasmussen Creek headwaters	MST269[1]								Dry		0.011								Dry	Dry	0.00072	Dry	Dry	0.071	Dry

Notes:
[1]—denotes a headwater station that is a surface expression of groundwater.
All units in mg/L
Selenium concentration represent the unfiltered or total fraction
Blank cell indicates that no sampling occurred for that sampling event
Data are not validated

3.2 2ND PHASE — ANALYTICAL SCREENING

The second phase consisted of water quality screening from the surface water monitoring stations retained from Phase 1 against the current list of approved surface water analytes from IDEQ (IDEQ, 2008).

The current list of approved analytes is (IDEQ, 2008):

- Cadmium (Cd), Chromium (Cr), Manganese (Mn), Nickel (Ni), Vanadium (V), Zinc (Zn)(dissolved)
- Aluminum (Al), Calcium (Ca), Iron (Fe), Magnesium (Mg), Potassium (K), Sodium (Na) (dissolved)
- Selenium (Se) (total)
- Total alkalinity as calcium carbonate ($CaCO_3$)
- Sulfate (SO_4), Chloride (Cl)
- Residue, filterable (total dissolved solids)
- Residue, non-filterable (total suspended solids)

The maximum uncensored value reported at the spatially relevant stations was compared to the appropriate screening value, in a hierarchal fashion. For the fall 2008 data, the detected value or the method detection limit was used (e.g., <0.005 changed to 0.005 for screening). The use of uncensored values does not necessarily imply that all maximum values were also below the detection limits. Where replicates and/or duplicates were collected and analyzed, each discrete replicate and/or duplicate and the average were also compared against the appropriate screening value.

3.2.1 Screening Criteria

Table 3-2, *Achievable Laboratory Limits and Applicable Project Screening Values Surface Water and Groundwater,* presents the available screening criteria that were compiled for this analytical screening phase. This table also shows the highlighted screening value chosen for screening surface water data. The applicable screening values were evaluated for each of the surface water analytes. The evaluations of screening values considered first the use of an applicable promulgated standard and second the use of the most conservative surface water screening value. The standards considered for screening analytes are presented below,

1) IDAPA 58.01.02 Water Quality Standards CCC for the protection of aquatic organisms. Cadmium, nickel, selenium, and zinc were evaluated under these standards. Hardness-dependent criteria were calculated for cadmium, nickel, and zinc.

2) IDAPA 58.01.11 Ground Water Quality Rule Secondary Constituents Standards based on aesthetic qualities (Secondary standards are based on protecting consumers from adverse tastes, odors, or appearance and do not necessarily pose a health risk).

   Manganese, aluminum, iron, chloride, sulfate, and total dissolved solids were evaluated under these standards. These values were used because no CCC standards were available from level 1 above or risk management plan levels and these are Idaho state standards. Additionally, eight spatially relevant retained headwater stream stations are also considered surface expressions of groundwater, so the application of these screening levels is relevant. All these standards are secondary, and are at least equally or more conservative than EPA Region 9, Region 3 risk-based concentrations, or EPA maximum contaminant levels.

3) IDEQ Risk Management Plan Monitoring Action Level for Regulated Surface Water Trending and Release Detection.

   Chromium and vanadium were evaluated under these advisory levels. Unspeciated, dissolved chromium was screened against this level, since chromium screening levels under IDAPA 58.01.02 are for the speciated fractions and the risk management plan contains an advisory level for dissolved, unspeciated chromium (most relevant and directly comparable to the chromium data that P4 has collected). The risk management plan advisory levels are based on the maximum observed area-wide investigation background concentrations.

4) EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites—Generic Tables.

   Aluminum, iron, manganese, and uranium were secondarily evaluated under these risk-based concentrations for tap water. These three chemicals (Al, Fe, and Mn) were evaluated under a second tier for limited exceedances observed for secondary groundwater criteria, since Idaho secondary groundwater criteria are not health based, and the EPA benchmarks are human health risk-based concentrations. Uranium was evaluated under this screening level due to limited exceedances observed at only one location.

5) EPA National Primary Drinking Water Standards Maximum Contaminant Levels.

   Uranium was also evaluated using this benchmark. However, since water from the stations is not used as a source of drinking water, the use of the EPA RSLs are appropriate for evaluation.

Additional screening values that could be considered for future use, but were not used in this evaluation include:

6) EPA freshwater standards from the National Recommended Water Quality Criteria for Priority Pollutants.

These acute and chronic freshwater standards may be useful for evaluating various analytes, following the applicable or relevant and appropriate requirements evaluation to be conducted in the future prior to formal risk assessment.

Magnesium, potassium, sodium, alkalinity, calcium, and total suspended solids were excluded from this screening since screening benchmarks were not available from the sources listed in Table 3-2. However, the need for these analytes will be evaluated for water quality evaluations in 2009 and 2010. Where appropriate, dissolved or total values were used in the screening exercise based on IDAPA guidance and to be comparable to the screening criteria. Dissolved calcium and magnesium values were used for calculating hardness as equation inputs to those chemicals which have hardness-dependent criteria. Hardness was calculated using the following equation (from SM2340B):

$$\text{Hardness, mg equivalent } CaCO_3/L = 2.497\ [\text{Ca, mg/L}] + 4.118\ [\text{Mg, mg/L}]$$

For those hardness-dependent criteria, the minimum hardness for each specific station was initially used to calculate the hardness-dependent criteria as a conservative approach to keep screening benchmarks initially low (increased hardness reduces the amount of dissolved metal responsible for toxicity in the water column [MDEP, 2001, USGS, 2001], i.e., the greater the hardness, the higher the calculated benchmark becomes). When a concentration exceeded the calculated criterion, the calculated hardness relevant to that exceedance was applied to the equation to determine if the chemical exceedance was valid and not an artifact of using the minimum hardness.

			Achievable Laboratory Limits [2]		Applicable Screening Levels																	
					State of Idaho Standards				IDEQ Area Wide RMP [6]					EPA MCL [12]		EPA Regional SL [13]	Health Comparison Values of Drinking Water [14]		National Standards Aquatic Life [15]			
					Ground Water [3]	Surface Water [4]	Aquatic Life [5]		Groundwater Levels		Surface Water Levels								Freshwater		Organism Consumption	
Method	Monitoring Parameter [1]	Units	RL	MDL			Acute	Chronic	Removal [7]	Monitoring [8]	Removal A [9]	Removal B [10]	Monitoring [11]	Primary	Secondary	Tap Water	Child	Adult	Acute	Chronic	W+O	O Only
EPA 6020A	Cadmium	mg/L	0.0005	0.000125	0.005	- -	0.0013 [b]	0.0006 [b]	0.005	0.0010	0.0010	0.245	0.0007	- -	- -	0.018	- -	- -	0.0020 [c]	0.00025 [c,d]	- -	- -
	Chromium (total)	mg/L	0.002	0.0005	0.1	- -	0.57/0.016 [b,e]	0.074/0.011 [b,e]	0.1	0.0250	0.0740	8.7	0.0058	0.1	- -	55/0.11 [e]	0.1	0.1	0.57/0.016 [c,e]	0.074/0.011 [c,e]	- -	- -
	Manganese	mg/L	0.002	0.0005	(0.05)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.88	- -	- -	- -		- -	- -
	Nickel	mg/L	0.004	0.001	- -	0.61	0.47 [b]	0.052 [b]	0.73	0.160	0.1600	0.614	0.0040	- -	- -	0.73	- -	- -	0.47 [c]	0.052 [c]	0.61	4.6
	Selenium	mg/L	0.001	0.0005	0.05	0.17	0.020 [f]	0.005 [f]	0.050	0.0050	0.0050	0.005 [g]	0.0016	- -	- -	0.18	- -	- -	notes [h,i]	0.0050 [h]	0.17	4.2
	Uranium	mg/L	0.040	0.010	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.03 [d]	- -	0.11	0.03 [d]	0.03 [d]	- -		- -	- -
	Zinc	mg/L	0.025	0.005	(5)	7.4	0.12 [b]	0.12 [b]	5.0	0.100	0.1000	43.4	0.059	- -	- -	11	- -	- -	0.12 [c]	0.12 [c]	7.4	26
EPA 6010B	Aluminum	mg/L	0.1	0.05	(0.2)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	37	- -	- -	- -	- -	- -	- -
	Calcium	mg/L	0.2	0.1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
	Iron	mg/L	0.1	0.025	(0.3)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	26	- -	- -	- -	- -	- -	- -
	Magnesium	mg/L	0.5	0.25	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
	Potassium	mg/L	1	0.25	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
	Sodium	mg/L	0.5	0.25	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
	Vanadium	mg/L	0.01	0.005	- -	- -	- -	- -	0.26	0.020	0.0200	0.972	0.0081 [d]	- -	- -	0.26	- -	- -	- -	- -	- -	- -
EPA 300.0	Chloride	mg/L	0.2	0.1	(250)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
	Sulfate	mg/L	1	0.5	(250)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
SM2340B	Hardness	mg/L	5	5	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
EPA 310.2	Alkalinity, total	mg/L	10	5	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
EPA 160.1	TDS	mg/L	10	5	(500)	- -	- -	- -	- -	- -	- -	- -	- -	- -	500	- -	- -	- -	- -	- -	- -	- -
EPA 160.2	TSS	mg/L	5	2.5	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

Primary source for screening   Secondary choice for screening   No available screening benchmark

[1] The event-specific target parameter list will be established prior to the monitoring event; samples may or may not be analyzed for all listed parameters.
[2] Generally achievable laboratory reporting limits; method detection limits may vary annually.
[3] State of Idaho Ground Water Quality Rule (IDAPA 58.01.11); secondary standard in parentheses.
[4] State of Idaho Surface Water Quality for Domestic Water Supply Use (IDAPA 58.01.02).
[5] State of Idaho Surface Water Quality for Aquatic Life (IDAPA 58.01.02); Acute Criteria (CMC) and Chronic Criteria (CCC).
[6] Removal action and monitoring levels; Area Wide Risk Management Plan (RMP; IDEQ 2004).
[7] Values are "total recoverable" (unfiltered).
[8] Values are unfiltered.
[9] Removal action levels are those for the CWA/State Water Quality Rules for Regulated Surface Water. All values, except those for selenium and vanadium, are based on hardness-adjusted dissolved constituent analyses; selenium value is "total recoverable" and vanadium value is dissolved (neither are hardness dependant).
[10] Removal action levels those are for surface waters not subject to CWA/IDAPA Biota Standards.
[11] Monitoring action levels, except that for selenium, are based on dissolved constituent analyses; selenium value is "total recoverable."
[12] EPA primary and secondary Maximum Contaminant Level (MCL), National Primary Drinking Water Regulations, EPA (http://www.epa.gov/safewater/contaminants/index.html#rads, 17 March 2008).
[13] EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, 12 September 2008).

[14] Public Health Assessment: Southeast Idaho Phosphate Mining Resource Area: Bannock, Bear Lake, Bingham, and Caribou Counties, Idaho EPA Facility ID: IDN001002245 (U.S. Department of Health and Human Services, Public Health Services, Agency for Toxic Substances and Disease Registry, 2006).
[15] National Recommended Water Quality Criteria for Priority Toxic Pollutants (USEPA, 2006); Freshwater standards for Acute Criteria (CMC) and Chronic Criteria (CCC); Criteria for Human Health for Organism Consumption of Water + Organism (W+O) and Organism Only (O Only).

[a] Reporting limit and MDL are greater than screening value.
[b] Aquatic life criteria for these metals are expressed as a function of total hardness (mg/L as calcium carbonate), the pollutant's water effect ratio (WER) as defined in Subsection 210.03.c.iii of IDAPA 58.01.02 and multiplied by an appropriate dissolved conversion factor as defined in Subsection 210.02. For comparative purposes only, the values displayed in this table are shown as dissolved metal and correspond to a total hardness of one hundred (100) mg/L and a water effect ratio of one (1.0).

[c] The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. The value given here corresponds to a hardness of 100 mg/L. Criteria values for other hardness may be calculated from the following: CMC (dissolved) = exp {mA[ln(hardness)]+bA} (CF), or CCC (dissolved) = exp {mC[ln(hardness)]+bC} (CF) and the parameters specified in Appendix B - Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent.
[d] Reporting limit is greater than screening value, but MDL is less than the screening value.
[e] Values specified are for chromium III/VI. If data are screened against these standards, then the total chromium results will be compared to the chromium VI standard.
[f] Criterion is expressed as total recoverable (unfiltered) concentration.
[g] Selenium values are 0.005 mg/L for riparian habitat use, 0.050 mg/L for domestic animal drinking water use, and 0.201 mg/L for transitory wildlife drinking water.
[h] The CMC = 1/[(f1/CMC1)+(f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 0.1859 mg/L and 0.01282 mg/L, respectively.
[i] This recommended water quality criterion for selenium is expressed in terms of total recoverable metal in the water column. It is scientifically acceptable to use the conversion factor (0.996- CMC or 0.922-CCC) that was used in the GLI (60FR15393-15399, March 23, 1995; 40CFR132 Appendix A) to convert this to a value that is expressed in terms of dissolved metal.

CWA - Clean Water Act
IDAPA Idaho Administrative Protection Agency'
IDEQ - Idaho Department of Environmental Quality
mg/L - milligrams per liter
na - not applicable to this method
pCi/L - picocuries per liter
SL - screening level
TDS - total dissolved solids
TSS - total suspended solids

The results of the screening effort are compiled below in Table 3-3, *Summary of Maximum Factors of Exceedances for Retained Surface Water Monitoring Stations* and Table 3-4, *Summary of Sampling Events and Exceedances for Retained Surface Water Monitoring Stations.* As depicted in the tables, nearly all stations have at least one exceedance of a chemical. Mainly selenium, aluminum, and to a lesser extent vanadium and manganese produced the most exceedances for a particular chemical.

TABLE 3-3
SUMMARY OF MAXIMUM FACTORS OF EXCEEDANCES
FOR RETAINED SURFACE WATER MONITORING STATIONS

Location	Se	Cd	Cr	Ni	V	Zn	Cl[a]	Fe[a]	SO_4[a]	Al[a]	Mn[a]	TDS[a]	U
MST019	1.8									1.9	1.2		
MST020	1.6							1.1		6	1.7		
MST050					2.8					7.7	7.5		
MST066	9.2				1.7					8.0			
MST067	116	3.5			3.2				3.6	1.8	1.1	3.4	
MST069	230				3.1				5.2	1.4		4.4	2.3
MST089	5												
MST090													
MST092	8.8												
MST093					1.4					1.5			
MST094	4.6												
MST095	78							1.5	1.6	3.1		1.7	
MST044	9.2				11							1.3	
MST045					3.1							1.3	
MST051													
MST057	2.4									4.2			
MST063	1.4												
MDS025	340	1.5	3.3	1.7	9.2			22	3.4		100		
MST128										2.7	1.6		
MST131								1.4		4.1			
MST132										2.3	1.9		
MST133	1.4									5.5			
MST136	7.8									1.4			
MST143										3.8			
MST269	14.2	14.2		2.9	1.2	4.2	1.1	1.1		2.9			
TOTAL	**16**	**3**	**1**	**2**	**9**	**1**	**1**	**5(0)**	**4**	**16(0)**	**7(1)**	**5**	**1(0)**

Notes:
A value indicates at least one maximum observed value exceeded the relevant screening criterion. The value presented is the maximum factor of exceedance for that analyte at that location. Blank cells indicate no exceedance of screening criteria.
Shading in the Fe, Al, Mn, and U columns indicates that this primary exceedance passed the secondary screening using EPA regional screening levels risk-based benchmarks for tap water, with a calculated factor of exceedance below 1.0.
The station list comprises those stations which are spatially relevant to P4's site-specific mine investigation.
[a] denotes screening against a secondary groundwater standard. Secondary standards are based on protecting consumers from adverse tastes, odors, or appearance and do not necessarily pose a health risk.

TABLE 3-4
SUMMARY OF SAMPING EVENTS AND EXCEEDANCES
FOR RETAINED SURFACE WATER MONITORING STATIONS

Location	Se	Cd	Cr	Ni	V	Zn	Cl[a]	Fe[a]	SO_4[a]	Al[a]	Mn[a]	TDS[a]	U
MST019	3/19									2/5	1/5		
MST020	6/13							1/7		2/5	2/5		
MST050					3/12					2/5	1/1		
MST066	4/6				2/6					1/4			
MST067	7/7	7/7			7/7				5/5	2/5	1/2	2/2	
MST069	15/15				1/15				9/9	1/5		4/4	3/4
MST089	2/7												
MST090													
MST092	4/5												
MST093					1/5					1/3			
MST094	2/6												
MST095	8/8							1/3	4/6	1/3		2/2	
MST044	1/5				1/5							1/1	
MST045					1/6							1/1	
MST051													
MST057	5/6									2/5			
MST063	2/4												
MDS025	3/5	2/5	2/5	4/5	1/5			1/2	4/5		1/2		
MST128										3/5	1/2		
MST131								1/4		2/5			
MST132										3/5	3/4		
MST133	1/9									3/3			
MST136	6/6									1/2			
MST143										2/4			
MST269	2/3	2/3		1/3	1/3	1/3	1/3	1/2		1/2			

Notes:
A value indicates at least one maximum observed value exceeded the relevant screening criterion. The values presented are the number exceedances of screening criteria / number of sampling events (e.g., 3/19, 3 exceedances of the screening criteria during 19 sampling events). Blank cells indicate no exceedance of screening criteria.
Shading in the Fe, Al, Mn, and U columns indicates that this primary exceedance passed the secondary screening using EPA regional screening levels risk-based benchmarks for tap water.
The station list comprises those stations which are spatially relevant to P4's site-specific mine investigation.
[a] denotes screening against a secondary groundwater standard. Secondary standards are based on protecting consumers from adverse tastes, odors, or appearance and do not necessarily pose a health risk.

Aluminum, iron, and manganese were evaluated secondarily against EPA regional screening levels risk-based concentrations. Only MDS025 exceeded the EPA regional screening level risk-based concentration for manganese in tap water during May 2001. (This period was the first time this location was sampled, and was dug out with a shovel, creating a depression for the water to pool. The muddy water was allowed to settle before sampling, but may account for the high manganese value present in May 2001.) Out of five sampling events evaluated, MDS025 produced water for two events (May 2001 and May 2006), and was dry the remaining three events. The May 2009 manganese concentration was 5 mg/l, and the May 2006 manganese concentration was 0.012 mg/L.

Neither aluminum nor iron had any exceedances when compared against EPA regional screening levels risk-based concentrations for tap water.

The initial aluminum screening against the Idaho secondary groundwater standard at 0.20 mg/L showed 16 out of 25 locations exceeding the Idaho secondary benchmark. The aluminum concentrations at spatially relevant locations ranged from 0.0030 mg/L (MST069 in spring 2006) up to 1.6 mg/L (MST066 in fall 2007). Comparing aluminum results against the EPA regional screening level at 37 mg/L, none of the aluminum concentrations exceed this benchmark.

Uranium was evaluated for spring and fall for 2007 and 2008. Only at MST069 were uranium concentrations observed above the EPA maximum contaminant levels. The range of values at MST069 was from 0.017 mg/L to 0.0685 mg/L. The EPA MCL for uranium is 0.030 mg/L. Three out of four measurements exceeded the EPA MCL. None of the four exceeded the EPA regional screening level of 0.11 mg/L. Screening against the secondary screening level from the EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites results in all uranium concentrations at all spatially relevant locations below this EPA screening level.

3.2.2 Analyte Selection

The analyte selection below presents P4's proposed analyte list for 2009 and 2010 monitoring.

IDEQ (2004) recommends cadmium, selenium, and zinc for mine-specific contaminants of concern in surface water. Copper, chromium, nickel, and vanadium can be excluded from the future mine-specific surface water analyte lists.

Based on the results shown in Table 3-3, and in concert with recommendations from the RMP (IDEQ, 2004), P4 proposes the following analytes for surface water performance monitoring at the spatially relevant stations:

- Selenium, total (SW6020A)
- Cadmium, dissolved (SW6020A)
- Vanadium, dissolved (SW6010B)
- Iron, dissolved (SW6010B)
- Sulfate, dissolved (EPA 300.0)
- Chloride, dissolved (EPA 300.0)
- Calcium, dissolved (SW6010B)
- Magnesium, dissolved (SW6010B)
- Total dissolved solids, total (EPA 160.1)

In addition to the recommendations from IDEQ (2004) for cadmium and selenium analytes retained for mine-specific contaminants of concern in surface water, P4 proposes vanadium as part of the metals list, due to the number of exceedances in spatially relevant locations (9 out of 25). Chloride and sulfate were retained. Chloride can be used as an indicator of aquatic toxicity; sulfate can be an indicator of mine drainage. Calcium and magnesium were retained for the sole purpose of calculating hardness-dependent criteria for cadmium and zinc. Total dissolved solids were retained due to the number of exceedances in spatially relevant locations (5 out of 25). Iron is included to allow for limited water typing analyses. Zinc was eliminated since there was only one station (MST069) that reported an exceedance. Alkalinity, sodium, and potassium have also been excluded from the analyte list since none of these chemicals impact water quality, and their usefulness in geochemical typing of water has previously been established. P4 has collected sufficient alkalinity, sodium, and potassium water quality data for geochemical typing and evaluation. For any new sites that may be added to this program, P4 will include alkalinity, sodium, and potassium in the analytical suite.

In addition to the recommended analytes, P4 will also take flow measurements for calculating discharge and collect physical water quality parameters. These include:

- Dissolved oxygen
- pH
- Specific Conductivity
- Conductivity
- Water temperature
- ORP
- Turbidity

Chromium and nickel were excluded following the IDEQ (2004) recommendations and as shown by the limited number of exceedances in Table 3-3 (1 out of 25 [Cr] and 2 out of 25 [Ni]). Aluminum, manganese, and uranium were not retained because all but one manganese concentration passed a secondary screening of risk-based benchmarks. Total suspended solids were not retained as there is no screening criterion, and total dissolved solids were retained.

3.2.3 Seasonal Sampling Evaluation

Based on A/T direction, P4 evaluated the spring and fall selenium and sulfate data collected in 2007 and 2008 at the spatially relevant locations. These data are presented below in Table 3-5, *Summary of Selenium and Sulfate Concentrations and Seasonal Sampling Evaluation.* This evaluation supported the decision to sample some stations in the fall as well as the spring. Those sites with higher selenium and sulfate concentrations in the fall as compared to spring were retained for sampling. For a site to be retained for fall sampling, both selenium and sulfate concentrations had to have been higher than in spring for the given year. Based on the results of the seasonal selenium and sulfate concentrations MST019, MST020, MST069, and MST044 will be retained for fall sampling. In addition, due the higher sulfate values reported in fall 2007 and fall 2008 for MST045, the A/T requested that this station be retained for fall sampling.

TABLE 3-5
SUMMARY OF SELENIUM AND SULFATE CONCENTRATIONS AND SEASONAL SAMPLING EVALUATION

	Spring 2007		Fall 2007		Spring 2008		Fall 2008				
	Se	SO4	Se	SO4	Se	SO4	Se	SO4			
Location	Max	Max	Max	Max	Max	Max	Max	Max	Se higher in fall?	SO4 higher in fall?	Are Se & SO4 concentrations greater in fall? (If yes, then sample in fall)
MST019	0.0040	11	0.0050	12.7	0.0040	13	0.0017	12	Yes	Yes	Yes
MST020	0.0040	10	0.0050	12.5	0.0050	14	0.0015	12	Yes	Yes	Yes
MST050	0.0050	10	0.0050	12.3	0.0050	45	0.0025	1.7	No	Yes	No
MST066	0.023	34	0.0050	41	0.019	51	Dry	Dry	No	Yes	No
MST067	0.022	475	Dry	Dry	0.41	590	Dry	Dry	--	--	--
MST069	1.1	1290	0.034	1340	0.87	990	1.2	1200	Yes	Yes	Yes
MST089	0.0050	13	Dry	Dry	0.0040	95	Dry	Dry	--	--	--
MST090	0.0050	2.1	Dry	Dry	0.0050	16	Dry	Dry	--	--	--
MST092	0.0050	45	Dry	Dry	0.0070	86	Dry	Dry	--	--	--
MST093	0.0050	6.8	Dry	Dry	0.0010	13	Dry	Dry	--	--	--
MST094	0.0050	7.5	Dry	Dry	0.0020	7.1	Dry	Dry	--	--	--
MST095	0.073	147	Dry	Dry	0.23	294	Dry	Dry	--	--	--
MST044	0.0050	109	0.0460	185	0.0050	73	0.0013	174	Yes	Yes	Yes
MST045	0.0050	111	0.0050	173	0.0050	63	0.0012	169	No	Yes	Yes
MST051	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	--	--	--
MST057	0.0060	52	0.0030	36.5	0.0090	46	0.0045	43	No	No	No
MST063	0.0050	42	Dry	Dry	Dry	Dry	Dry	Dry	--	--	--
MDS025	0.056	838	Dry	Dry	Dry	Dry	Dry	Dry	--	--	--
MST128	0.0050	43	0.0050	53	0.0050	41	0.00074	33	No	Yes	No
MST131	0.0020	29	0.0020	16	0.0020	34	0.0022	16	Yes	No	No
MST132	0.0050	39	0.0050	40	0.0040	41	0.0013	28	No	Yes	No
MST133	0.0010	19	Dry	Dry	0.0050	11	Dry	Dry	--	--	--
MST136	Dry	Dry	Dry	Dry	0.021	41	Dry	Dry	--	--	--
MST143	0.0050	134	Dry	Dry	0.0030	35	0.0026	16	No	No	No
MST269	Dry	Dry	Dry	Dry	0.071	155	Dry	Dry	--	--	--

Notes:
Units in mg/L
Station should be sampled in the fall.

4.0 REFERENCES

IDEQ, 2002. *Final Area Wide Human Health And Ecological Risk Assessment Selenium Project Southeast Idaho Phosphate Mining Resource Area*. Prepared by Tetra Tech EM, Inc. for Idaho Department of Environmental Quality. December 2002.

IDEQ, 2004. Area Wide Risk Management Plan: Removal Action Goals And Objectives, And Action Levels For Addressing Releases And Impacts From Historic Phosphate Mining Operations In Southeast Idaho. Prepared by Idaho Department of Environmental Quality. February 2004.

IDEQ, 2008. Re: List of Analytes to Sample for Fall 2008 Sampling Event. Letter from M. Rowe (IDEQ) to B. Koch (P4). 16 September 2008.

IDEQ, 2009. Email communication: P4 Monsanto – Surface Water Sampling for 2009. Mike Rowe and Doug Tanner, IDEQ, January 16, 2009.

MDEP, 2001. Maine Department Of Environmental Protection Total Hardness Protocol. March 5, 2001. Website accessed 25 February 2009. www.maine.gov/dep/blwq/docstand/hardness.pdf.

MWH, 2004a. Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan − Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program. Prepared for P4 Production. March.

MWH, 2004b. Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Project Field Sampling Plan − Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program. Prepared for P4 Production. April.

MWH, 2004c. Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Quality Assurance Plan − Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program. Prepared for P4 Production. April.

MWH, 2004d. Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Health and Safety Plan − Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program. Prepared for P4 Production. April.

MWH, 2004e. Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Field Sampling Plan − Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program. Prepared for P4 Production. April.

MWH, 2007. 2007 & 2008 Surface Water Monitoring Plans—Final. Prepared for P4 Production. May 2007.

MWH, 2009. Quality Assurance Project Plan Addendum Program Quality Assurance Plan - Final. Prepared for P4 Production. May.

USEPA, 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4. U.S. Environmental Protection Agency, Washington DC, EPA/240/B-06/001.

USGS, 2001. Water-Quality Characteristics in the Black Hills Area, South Dakota. Water-Resources Investigations Report 01-4194. Website accessed 25 February 2009. http://pubs.usgs.gov/wri/wri014194/pdf/.

Figure 1: Spring 2008 Selenium Spatial Wire Diagram with 2009 Sampling Locations

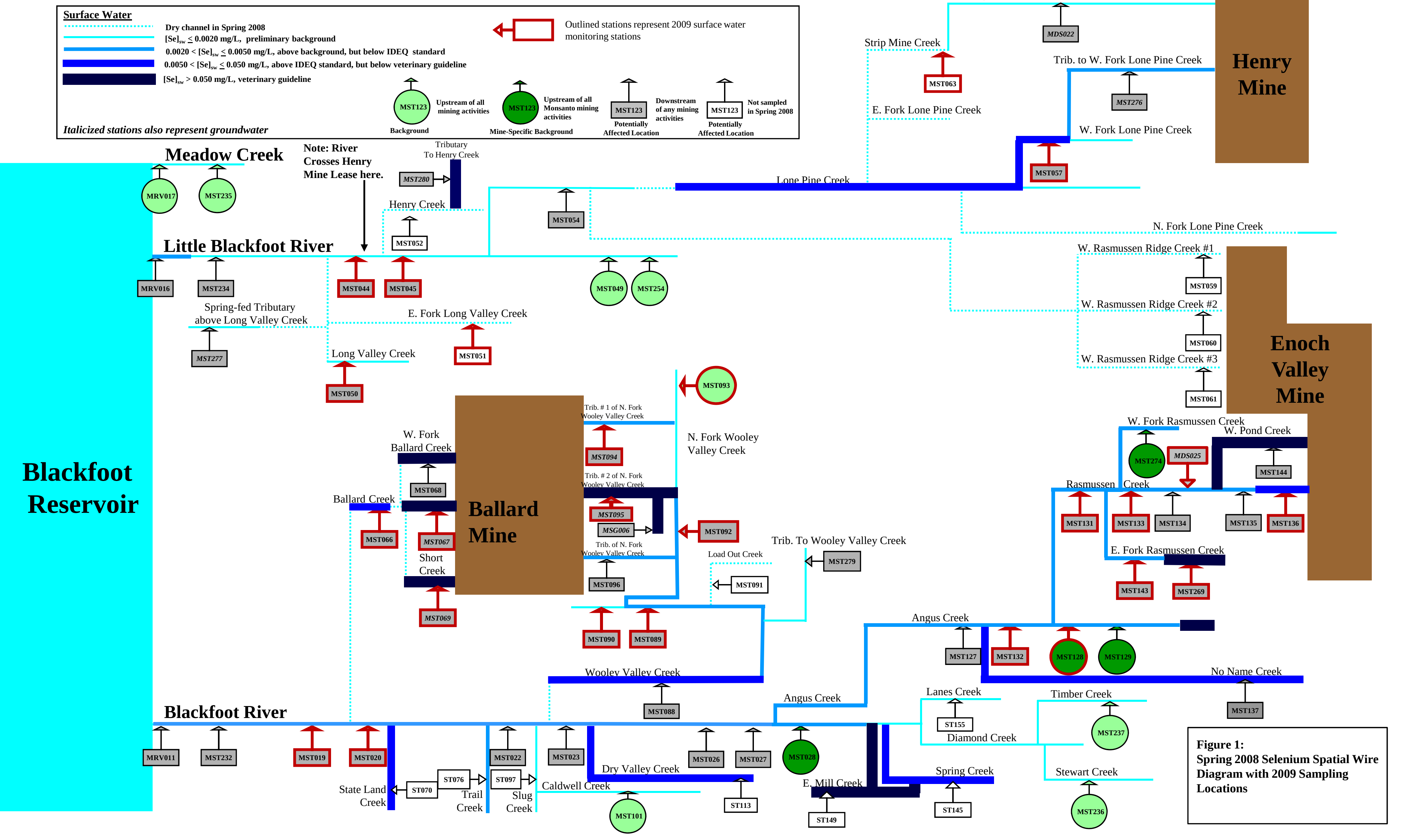


Figure 1:
Spring 2008 Selenium Spatial Wire Diagram with 2009 Sampling Locations

APPENDICES

APPENDIX A – FIELD SAMPLING PLAN

2009 & 2010 SURFACE WATER MONITORING

FIELD SAMPLING PLAN

FINAL
Revision 2

May 22, 2009

TABLE OF CONTENTS

1.0 INTRODUCTION **1-1**
2.0 PROGRAM BACKGROUND AND OBJECTIVES **2-1**
3.0 SAMPLE LOCATIONS, FREQUENCY, AND SCHEDULE **3-1**
4.0 SAMPLE COLLECTION AND ANALYSIS **4-1**
4.1 Site Access, Logistics, and Safety 4-1
4.2 Surface Water Collection 4-1
4.3 Surface Water Field Parameter Measurements 4-4
4.4 Surface Water Flow Measurements 4-4
4.5 Sample Designation 4-5
4.6 Sample Handling and Shipping 4-6
4.7 Sample Analysis 4-6
4.8 Sampling Quality Assurance 4-7
5.0 PROJECT ORGANIZATION **5-1**
5.1 Project Team 5-1
5.2 Project Schedule 5-2
5.3 Project Deliverables 5-2
6.0 REFERENCES **6-1**

LIST OF TABLES

Table 3-1 Surface Water Monitoring Locations, Frequency, and Schedule
Table 4-1 Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times
Table 4-2 Calibration and Maintenance Requirements for Field Equipment
Table 4-3 Surface Water Analytes
Table 4-4 Sample Tracking Form
Table 5-1 Project Contacts

LIST OF DRAWINGS

Drawing 1 Surface Water Sampling Locations

ATTACHMENTS

Attachment 1 Standard Operating Procedures

ACRONYMS AND ABBREVIATIONS

A/T	Agencies and Tribes
DQOs	Data Quality Objectives
e.g.	*exempli gratia* (Latin, for example)
FSP	Field Sampling Plan
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
i.e.	*id est* (Latin, that is to say; in other words)
HDPE	high-density polyethylene
mg/L	Milligrams per Liter
MWH	MWH, Inc. (formerly Montgomery Watson Harza, Inc.)
P4	P4 Production, L.L.C.
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure

1.0 INTRODUCTION

This Field Sampling Plan (FSP) details the work scope for surface water monitoring at existing stations around P4's Ballard, Henry, and Enoch Valley Mines. This FSP is an attachment to the *2009 & 2010 Surface Water Monitoring Sampling and Analysis Plan* (SAP). The SAP presents the Data Quality Objectives (DQOs) that have been developed to guide the monitoring program presented in this FSP. The complementary documents to the FSP are the *Final Quality Assurance Program Plan (QAPP) Addendum* (MWH, 2009) and *Health and Safety Plan* (HSP). The QAPP is included by reference and the FSP and HSP are included as Appendix A and B of the SAP, respectively.

The FSP is organized as follows:

Section 1 – Introduction

Section 2 – Program Background and Objectives: provides a brief summary of information related to the need for continued surface water monitoring, and information on the available historic data as well as the sampling objectives and design rationale

Section 3 – Sample Locations, Frequency, and Schedule: specifies the field sampling and analysis activities

Section 4 – Sample Collection and Analysis: summarizes protocols for all sample collection and handling procedures and sample analyses and laboratory methods

Section 5 – Project Organization: presents the project team, schedule, and deliverables

Section 6 – References

2.0 PROGRAM BACKGROUND AND OBJECTIVES

This section provides brief background information related to surface water monitoring for the Ballard, Henry, and Enoch Valley Mines. Additional program background details may be obtained from the *2004 Site Investigation Work Plans* (MWH, 2004) and the *2007 and 2008 Surface Water Monitoring Plans* (MWH, 2007).

The monitoring program presented in this FSP was specifically requested by the Agencies and Tribes (A/T) in an email dated January 16, 2009 to P4 (IDEQ, 2009). This email requested that surface water monitoring continue to provide a continuous record of conditions for evaluation of potential remedy effectiveness and allow for a greater understanding of potential long-term trends.

The objective of previous surface water monitoring conducted at the sites (2004-2008) was to support nature and extent characterization. However, P4 and A/T largely believe that there is now adequate surface water data to support the development of a Remedial Investigation. Therefore, the objective of the 2009 and 2010 monitoring is to develop baseline conditions from which to evaluate the effectiveness of potential future remediation. As a result of this new objective, the sampling stations, analytical parameters, and monitoring frequency were evaluated to meet these new objectives. This rationale as well as the screening and evaluation are documented in Section 3.0 of the SAP. In addition, the surface water data collected under this plan will also support the ongoing groundwater characterization and refinement of the hydrogeologic conceptual models of the Sites.

3.0 SAMPLE LOCATIONS, FREQUENCY, AND SCHEDULE

This section describes the surface water monitoring program sampling locations and frequencies. The sampling locations and frequencies are summarized programmatically below in Table 3-1, *Surface Water Sampling Locations, Frequency, and Schedule*. The locations of the 25 sampling stations are shown in Drawing 3-1, *Surface Water Sampling Locations*. These sampling locations were selected according to the rationale in Section 3.0 of the SAP.

TABLE 3-1 SURFACE WATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE						
Mine	**Feature Name[a]**	**Location**		**Station Number**	**2009 & 2010**	
		Latitude	**Longitude**		**Spring**	**Fall**
Ballard Mine	Blackfoot River below Ballard Creek	42 48 49.28	111 30 21.52	MST019	X	X
	Blackfoot River below State Land Creek	42 48 31.97	111 30 06.28	MST020	X	X
	Long Valley Creek below Ballard Mine	42 50 54.00	111 29 49.00	MST050	X	
	Ballard Creek above Blackfoot River	42 48 56.30	111 30 07.32	MST066	X	
	Ballard Creek headwaters	42 49 23.79	111 29 36.31	MST067	X	
	Short Creek below Ballard Mine	42 49 11.23	111 29 19.75	MST069	X	X
	Wooley Valley Creek, below *North Fork Wooley Valley Creek*	42 49 28.70	111 26 19.40	MST089	X	
	Wooley Valley Creek, above *North Fork Wooley Valley Creek*	42 49 28.00	111 26 49.00	MST090	X	
	North Fork Wooley Valley Creek above *Wooley Valley Creek*	42 49 40.00	111 27 04.30	MST092	X	
	North Fork Wooley Valley Creek above Ballard Mine	42 50 28.00	111 28 34.00	MST093	X	
	Spring-fed trib. #1 of N, Fork Wooley Valley Cr., below Ballard Mine	42 49 56.00	111 28 10.00	MST094	X	
	Spring-fed trib. #2 of N. Fork Wooley Valley Cr., below Ballard Mine	42 49 39.00	111 28 05.00	MST095	X	
Henry Mine	Immediately below Henry Mine (1997 #24)	42 53 50.60	111 29 24.80	MST044	X	X
	Little Blackfoot River above Henry Creek	42 54 10.70	111 29 30.10	MST045	X	X
	East Fork Long Valley Creek below Henry Mine	42 52 18.23	111 28 58.49	MST051	X	
	West Fork Lone Pine Creek above Lone Pine Creek	42 51 59.49	111 26 21.78	MST057	X	
	Strip Mine Creek below Henry Mine	42 52 01.70	111 27 03.40	MST063	X	
Enoch Valley Mine	Enoch Valley Mine, *West Dump Seep*	42 52 13.00	111 24 11.00	MDS025	X	
	Angus Creek above Rasmussen Creek	42 51 08.00	111 22 32.00	MST128	X	
	Rasmussen Creek above Angus Creek	42 51 08.00	111 22 31.00	MST131	X	
	Angus Creek Above *No Name Creek* and below *Rasmussen Creek*	42 51 07.00	111 22 29.00	MST132	X	
	Rasmussen Creek below Enoch Valley Mine	42 51 48.00	111 23 50.00	MST133	X	
	Rasmussen Creek headwaters near *Enoch Valley Mine Shop Pond*	42 52 34.00	111 25 03.00	MST136	X	
	East Fork Rasmussen Creek above *Rasmussen Creek*	42 51 31.70	111 23 01.40	MST143	X	
	East Fork Rasmussen Creek headwaters	42 52 16.57	111 23 41.69	MST269	X	

Notes:
[a] Stream names in *italics* were assigned by either IMA or P4 Production as these streams are unnamed on USGS maps or, as far as is known, are unnamed by common usage of local inhabitants. The reason for this is that most such streams are small with intermittent or ephemeral flows.
Location (GPS) coordinates use the NAD27 datum and are presented in ddd mm ss.ss format (degrees minutes seconds).

4.0 SAMPLE COLLECTION AND ANALYSIS

This section presents the site access requirements, equipment, and procedures for the collection, handling, and analysis of each surface water sample. Where applicable, references to SOPs in Attachment 1 are provided.

4.1 SITE ACCESS, LOGISTICS, AND SAFETY

P4 has access to all surface water monitoring locations. The A/T will be notified, at minimum, five business days prior to commencement of field activities. The MWH Field Team Leader will notify the P4 Project Manager (Barry Koch) at minimum three days prior to working at a mine area. Such notification is necessary to allow time for site-specific safety training by P4, and if necessary, to arrange for a P4 representative to accompany the crew to provide access through locked gates. Relevant P4, agency contacts, and other field contacts are provided in Section 5.0.

Field equipment and samples will be stored at the Fox Hills Ranch, owned by P4. Equipment, supplies, and samples will be shipped and received from the Monsanto plant, in Soda Springs, in care of Barry Koch, P4. Additional sample handling and shipping information is presented in Section 4.6.

Safety procedures for the site investigation are described in the HSP. Parts of the Enoch Valley Mine area are still active, and thus, Enoch Valley has its own safety requirements that will be followed by field personnel when working in, or traveling through, active areas of the site. The mine-specific safety requirements involve a short training orientation for hazard recognition and avoidance provided by P4. In the event that any of P4's safety policies are stricter than the requirements of the HSP, those safety requirements will take precedence.

4.2 SURFACE WATER COLLECTION

Surface water samples will be collected using the protocols outlined in SOP-NW-9.1, *Collection of Surface Water Samples*. This SOP is located in Attachment 1.

Water samples will be collected from streams using a Kemmerer horizontal water bottle sampler by taking a composite of three grabs across the channel. If the stream is too narrow or shallow to accommodate three grabs across the channel, three grabs will be taken along the channel, beginning downstream. Samples collected from small streams, seeps, and springs (stations not suitable for sampling by Kemmerer) will be taken using a suitable polyethylene container, i.e., the 1-Liter bottle from the swing sampler or a suitable pitcher. Water samples will be transferred to appropriate sample containers after collection and any required filtering.

Unfiltered, acidified samples will, as needed, be collected and analyzed for total metals. Filtered, acidified samples will, as needed, be collected and analyzed for "dissolved" metals. Filtered samples will be filtered in the field using a new 0.45-micron disposable filter at each sample location. Filtered and unfiltered, unacidified samples will also be collected for major ions. Parameters to be analyzed for are described below in Section 4.7. Refer to Table 4-1, *Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times* for analyte sample container requirements. Water samples will be collected upon arrival at the station, prior to field water quality and flow measurements, to ensure high-quality, undisturbed samples.

For sample documentation, digital photos will be taken at each sample location. A minimum of two photos should be taken at each location, one facing downstream, and one facing upstream, as appropriate.

TABLE 4-1 REQUIREMENTS FOR CONTAINERS, PRESERVATION TECHNIQUES, SAMPLE VOLUMES , AND HOLDING TIMES					
Sample Container—Water Matrices	**Preservative**	**Parameter***	**Method**	**Sample Preparation Method**	**Maximum Holding Time (Days)**
250 mL HDPE	Field filter; HNO_3 pH < 2	dissolved metals	EPA 6010B and 6020A	microwave-assisted acid digestion (3015 ICP-MS) or hot plate acid digestion (3005A ICP) - dissolved (field filtered)	180
250 mL HDPE	HNO_3 pH < 2	total metals	EPA 6010B and 6020A	microwave-assisted acid digestion (3015 ICP-MS) or hot plate acid digestion (3005A ICP) -raw	180
250 mL HDPE	≤ 6 °C	chloride	300.0	dissolved (field filtered)	28
250 mL HDPE	≤ 6 °C	total dissolved solids	160.1	total (raw)	7

Notes:
*Refer to Table 4-3, *Surface Water Analytes*, for surface water parameters and methods.
HDPE – high-density polyethylene

4.3 SURFACE WATER FIELD PARAMETER MEASUREMENTS

Field parameter measurements will be made in-situ whenever possible after the collection of surface water samples. If an in-situ measurement is not possible, then the measurement will be made streamside from a 5-Liter pitcher. Field parameter values will be recorded on field data forms and in the field notebooks. The following field water quality parameters will be measured:

- pH;
- Conductivity;
- Specific conductivity;
- Temperature;
- Dissolved oxygen;
- Turbidity; and,
- Oxidation-reduction potential.

Field meters will be used in accordance with the manufacturer's instructions and calibration in accordance with Table 4-2, *Calibration and Maintenance Requirements for Field Equipment*. Conductivity, dissolved oxygen, and pH meter performance will be calibrated and turbidimeters will be checked each morning prior to field sampling as well as at the end of each day. At the quality assurance/quality control (QA/QC) monitoring stations, all measurements will be taken three times.

TABLE 4-2
CALIBRATION AND MAINTENANCE REQUIREMENTS FOR FIELD EQUIPMENT*

Field Parameter	Required Procedure	Minimum Frequency	Required Equipment or Calibration Fluids
pH	2-point calibration	Each day prior to sampling and end of day	One pH buffer (7 pH), Reference Standard
Temperature	N/A	N/A	N/A
Dissolved Oxygen	Atmospheric calibration	Each day prior to sampling and end of day	Atmospheric oxygen with elevation
Conductivity	1-point reference	Each day prior to sampling and end of day	Reference Standard
ORP	1-point reference	Each day prior to sampling and end of day	Reference Standard
Turbidity	1-point calibration	Each day prior to sampling and end of day	Reference Standard
Flow	Velocity equivalence and spin test (Price meters) or equivalent	When the rotor is changed	Stopwatch, measuring tape

Notes:
*In the event of a discrepancy, the manufacturer's instruction manual shall take precedence.

4.4 SURFACE WATER FLOW MEASUREMENTS

Surface water flow rate measurements or estimates, if applicable, will be made from all surface water monitoring locations listed programmatically in Table 3-1 of this FSP in conjunction with the collection of the water quality sample. Flow measurements will always be recorded after the stream/seep water quality sample and field parameters have been collected to prevent potential contamination. Flow measurements will typically be measured with current meters using the velocity-area method (Rantz, 1982). For streams less than 0.2 feet deep, flow will be measured using a volumetric method, if possible. If a stream is too fast or deep to safely measure, then the flow will be estimated using an estimate of the stream cross-sectional area and the stream surface velocity by means of the "float method." Details of surface water flow measurement methods are presented in SOP-NW-9.2a, *Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques*, which is located in Attachment 1.

4.5 SAMPLE DESIGNATION

Samples will be labeled with all necessary information on laboratory supplied labels using waterproof ink. At a minimum, each sample label shall contain the following information:

- Station identification;
- Sample identification;
- Date and time of sample collection, with sampler's initials;
- Analyses required;
- Filtered or unfiltered;
- Method of preservation, if used; and,
- Sample matrix.

Each sample shall be assigned a unique identification number. This number shall be coded according to sample location according to the following format:

MYYaaa-SW-b-c

where:

- **M** designates "M" for Monsanto and is used to differentiate from other sample stations identified by MWH for Idaho Mine Association (IMA) mine-specific investigations.

- **YY** denotes the station type; station type which is ST for streams and DS for dump seeps.

- **aaa** denotes the specific station number/location.

- **SW** denotes that surface water is sampled.

- **b** denotes whether the sample involved special field handling or is to be handled in a specific manner; handling codes are as follows:

  F: Filtered
  U: Unfiltered

- **c** denotes the replicate number (-blank shall indicate no replicate samples; if there are QA/QC replicate samples, then 1, 2 and 3 represent the replicate samples.

As an example, sample number **MST020-SW-F** describes a non-replicated, filtered surface water sample collected at stream monitoring station MST020.

4.6 SAMPLE HANDLING AND SHIPPING

Sample containers will be sealed in plastic bags with wire ties and immediately placed on ice in an insulated cooler to ≤ 6 °C. Insulated coolers will be provided by Microbac or purchased locally. All samples will be stored in the coolers and handled as specified in Section 2.0 of the *Final QAPP Addendum* (MWH, 2009). All samples will remain in the coolers until the end of the day when all of the samples will be transferred to a locked refrigerator at the Fox Hills Ranch.

Samples will be shipped to Microbac with bagged wet ice in coolers secured with packing tape, via overnight Federal Express service to Microbac. MWH will fill out appropriate chain-of-custody forms; the chain-of-custody will be included with the sample shipment, and copies of all chains-of-custody along with Federal Express waybills will be kept by MWH field personnel.

All samples will be sent to Microbac at the following address:

Microbac
158 Starlite Drive
Marietta, OH 45750
(740) 373-4071
Attn: Kathy Albertson

Supplies including sample containers and coolers will be sent to the Monsanto Plant:

Monsanto Company
1853 HWY 34
Soda Springs, ID 83276
(208) 547-1439
Attn: Barry Koch

4.7 SAMPLE ANALYSIS

In spring and fall 2009 and 2010, samples will be analyzed for the surface water parameters presented in Table 4-3, *Surface Water Analytes*. The analyte list was developed based on the screening in Section 3.0 of SAP. Microbac of Marietta, Ohio will analyze for all parameters listed.

TABLE 4-3 SURFACE WATER ANALYTES					
Parameter	Basis	Method	RL	Reporting Units	Holding Times (days)
cadmium	dissolved	6020A	0.0005	mg/L	180
calcium	dissolved	6010B	0.2	mg/L	180
chloride	dissolved	300.0	0.2	mg/L	28
hardness	dissolved	2340B-Calculation	5	mg/L	n/a
iron	dissolved	6010B	0.1	mg/L	180
magnesium	dissolved	6010B	0.5	mg/L	180
selenium	total	6020A	0.001	mg/L	180
sulfate	dissolved	300.0	1	mg/L	28
total dissolved solids	total	160.1	10	mg/L	7
vanadium	dissolved	6010B	0.01	mg/L	180
Notes: Method—Method to be utilized by Microbac. RL—Reporting Limit of Microbac.					

4.8 SAMPLING QUALITY ASSURANCE

The following QA/QC procedures will be followed during surface water sampling:

- Collection of QA/QC samples will occur at a minimum rate of 10 percent of total stations.
- A QA/QC sample will consist of three field replicates.
- The equipment rinsate sample will be collected by rinsing decontaminated sampling equipment with deionized water in a manner similar to actual sample collection.
- The water blank will be a sample of the deionized water used for the equipment rinsate sample.
- Equipment rinsate and water blank samples will be collected on a daily basis, and, if more than one team collects samples on a given day, also by each sampling team.
- For matrix spike analysis, field teams will collect additional volume and designate on the chain-of-custody forms that the samples are for matrix spike analysis. Matrix spike samples will be collected on a daily basis.
- All sampling equipment will be decontaminated prior to sample collection.

Refer to the *Final QAPP Addendum* (MWH, 2009) for further details regarding surface water sampling QA/QC procedures. The QA/QC samples as well as a summary of all samples are provided on Table 4-4, *Sampling Tracking Form*.

TABLE 4-4
SAMPLE TRACKING FORM

					Laboratory Parameters							Field Parameters									
Field Sample Identification	**Location**	**Matrix**	**Filtered (check for yes)**	**QC Sample Type**	**Total Selenium (SW6020A)**	**Dissolved Cd (SW6020A)**	**Dissolved Ca, Fe, Mg, V (SW6010B/C)**	**Dissolved Cl and SO4 (E300.0)**	**TDS (E160.1)**	**Dissolved Hardness (SM2340B-Calc)**		**Conductivity (uS/cm)**	**Specific Conductivity (uS/cm)**	**pH**	**Dissolved Oxygen (% sat)**	**Dissolved Oxygen (mg/L)**	**Oxidation/Reduction Potential (mV)**	**Turbidity (ftu)**	**Water Temperature (ºC)**	**Air Temperature (ºC)**	**Discharge (ft^3/sec)**
SWMDS025-U	MDS025	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMDS025-F	MDS025	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST019-U	MST019	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST019-F	MST019	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST020-U	MST020	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST020-F	MST020	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST050-U	MST050	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST050-F	MST050	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST066-U	MST066	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST066-F	MST066	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST067-U	MST067	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST067-F	MST067	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST069-U	MST069	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST069-F	MST069	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST089-U	MST089	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST089-F	MST089	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST090-U	MST090	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST090-F	MST090	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST092-U	MST092	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST092-F	MST092	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST093-U	MST093	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST093-F	MST093	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X

TABLE 4-4
SAMPLE TRACKING FORM

					Laboratory Parameters							Field Parameters									
Field Sample Identification	**Location**	**Matrix**	**Filtered (check for yes)**	**QC Sample Type**	**Total Selenium (SW6020A)**	**Dissolved Cd (SW6020A)**	**Dissolved Ca, Fe, Mg, V (SW6010B/C)**	**Dissolved Cl and SO4 (E300.0)**	**TDS (E160.1)**	**Dissolved Hardness (SM2340B-Calc)**		**Conductivity (uS/cm)**	**Specific Conductivity (uS/cm)**	**pH**	**Dissolved Oxygen (% sat)**	**Dissolved Oxygen (mg/L)**	**Oxidation/Reduction Potential (mV)**	**Turbidity (ftu)**	**Water Temperature (ºC)**	**Air Temperature (ºC)**	**Discharge (ft^3/sec)**
SWMST094-U	MST094	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST094-F	MST094	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST095-U	MST095	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST095-F	MST095	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST044-U	MST234	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST044-F	MST234	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST045-1-U	MST045	Water		Triplicate	X				X			X	X	X	X	X	X	X	X	X	X
SWMST045-1-F	MST045	Water	X	Triplicate		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST045-2-U	MST045	Water		Triplicate	X				X			X	X	X	X	X	X	X	X	X	X
SWMST045-2-F	MST045	Water	X	Triplicate		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST045-3-U	MST045	Water		Triplicate	X				X			X	X	X	X	X	X	X	X	X	X
SWMST045-3-F	MST045	Water	X	Triplicate		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST051-U	MST051	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST051-F	MST051	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST057-U	MST057	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST057-F	MST057	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST063-U	MST063	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST063-F	MST063	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST128-U	MST128	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST128-F	MST128	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST131-U	MST131	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST131-F	MST131	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST132-1-U	MST132	Water		Triplicate	X				X			X	X	X	X	X	X	X	X	X	X

TABLE 4-4
SAMPLE TRACKING FORM

					Laboratory Parameters							Field Parameters									
Field Sample Identification	**Location**	**Matrix**	**Filtered (check for yes)**	**QC Sample Type**	**Total Selenium (SW6020A)**	**Dissolved Cd (SW6020A)**	**Dissolved Ca, Fe, Mg, V (SW6010B/C)**	**Dissolved Cl and SO4 (E300.0)**	**TDS (E160.1)**	**Dissolved Hardness (SM2340B-Calc)**		**Conductivity (uS/cm)**	**Specific Conductivity (uS/cm)**	**pH**	**Dissolved Oxygen (% sat)**	**Dissolved Oxygen (mg/L)**	**Oxidation/Reduction Potential (mV)**	**Turbidity (ftu)**	**Water Temperature (ºC)**	**Air Temperature (ºC)**	**Discharge (ft^3/sec)**
SWMST132-1-F	MST132	Water	X	Triplicate		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST132-2-U	MST132	Water		Triplicate	X				X			X	X	X	X	X	X	X	X	X	X
SWMST132-2-F	MST132	Water	X	Triplicate		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST132-3-U	MST132	Water		Triplicate	X				X			X	X	X	X	X	X	X	X	X	X
SWMST132-3-F	MST132	Water	X	Triplicate		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST133-U	MST133	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST133-F	MST133	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST136-U	MST136	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST136-F	MST136	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST143-U	MST143	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST143-F	MST143	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
SWMST269-U	MST269	Water		Primary	X				X			X	X	X	X	X	X	X	X	X	X
SWMST269-F	MST269	Water	X	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X
ER-SW-01-U	na	Water		ER	X				X												
ER-SW-01-F	na	Water	X	ER		X	X	X		X											
ER-SW-02-U	na	Water		ER	X				X												
ER-SW-02-F	na	Water	X	ER		X	X	X		X											
ER-SW-03-U	na	Water		ER	X				X												
ER-SW-03-F	na	Water	X	ER		X	X	X		X											
ER-SW-04-U	na	Water		ER	X				X												
ER-SW-04-F	na	Water	X	ER		X	X	X		X											
ER-SW-05-U	na	Water		ER	X				X												
ER-SW-05-F	na	Water	X	ER		X	X	X		X											

TABLE 4-4
SAMPLE TRACKING FORM

					Laboratory Parameters							Field Parameters									
Field Sample Identification	**Location**	**Matrix**	**Filtered (check for yes)**	**QC Sample Type**	**Total Selenium (SW6020A)**	**Dissolved Cd (SW6020A)**	**Dissolved Ca, Fe, Mg, V (SW6010B/C)**	**Dissolved Cl and SO4 (E300.0)**	**TDS (E160.1)**	**Dissolved Hardness (SM2340B-Calc)**		**Conductivity (uS/cm)**	**Specific Conductivity (uS/cm)**	**pH**	**Dissolved Oxygen (% sat)**	**Dissolved Oxygen (mg/L)**	**Oxidation/Reduction Potential (mV)**	**Turbidity (ftu)**	**Water Temperature (ºC)**	**Air Temperature (ºC)**	**Discharge (ft^3/sec)**
ER-SW-06-U	na	Water		ER	X				X												
ER-SW-06-F	na	Water	X	ER		X	X	X		X											
ER-SW-07-U	na	Water		ER	X				X												
ER-SW-07-F	na	Water	X	ER		X	X	X		X											
ER-SW-08-U	na	Water		ER	X				X												
ER-SW-08-F	na	Water	X	ER		X	X	X		X											
ER-SW-09-U	na	Water		ER	X				X												
ER-SW-09-F	na	Water	X	ER		X	X	X		X											
ER-SW-10-U	na	Water		ER	X				X												
ER-SW-10-F	na	Water	X	ER		X	X	X		X											
ER-SW-11-U	na	Water		ER	X				X												
ER-SW-11-F	na	Water	X	ER		X	X	X		X											
ER-SW-12-U	na	Water		ER	X				X												
ER-SW-12-F	na	Water	X	ER		X	X	X		X											
ER-SW-13-U	na	Water		ER	X				X												
ER-SW-13-F	na	Water	X	ER		X	X	X		X											
ER-SW-14-U	na	Water		ER	X				X												
ER-SW-14-F	na	Water	X	ER		X	X	X		X											
B-SW-01-U	na	Water		B	X				X												
B-SW-01-F	na	Water	X	B		X	X	X		X											
B-SW-02-U	na	Water		B	X				X												
B-SW-02-F	na	Water	X	B		X	X	X		X											
B-SW-03-U	na	Water		B	X				X												

TABLE 4-4 SAMPLE TRACKING FORM																				
					Laboratory Parameters							**Field Parameters**								
Field Sample Identification	**Location**	**Matrix**	**Filtered (check for yes)**	**QC Sample Type**	**Total Selenium (SW6020A)**	**Dissolved Cd (SW6020A)**	**Dissolved Ca, Fe, Mg, V (SW6010B/C)**	**Dissolved Cl and SO4 (E300.0)**	**TDS (E160.1)**	**Dissolved Hardness (SM2340B-Calc)**		**Conductivity (uS/cm)**	**Specific Conductivity (uS/cm)**	**pH**	**Dissolved Oxygen (% sat)**	**Dissolved Oxygen (mg/L)**	**Oxidation/Reduction Potential (mV)**	**Turbidity (ftu)**	**Water Temperature (°C)**	**Air Temperature (°C)**	**Discharge (ft^3/sec)**
B-SW-03-F	na	Water	X	B		X	X	X		X										
B-SW-04-U	na	Water		B	X				X											
B-SW-04-F	na	Water	X	B		X	X	X		X										
B-SW-05-U	na	Water		B	X				X											
B-SW-05-F	na	Water	X	B		X	X	X		X										
B-SW-06-U	na	Water		B	X				X											
B-SW-06-F	na	Water	X	B		X	X	X		X										
B-SW-07-U	na	Water		B	X				X											
B-SW-07-F	na	Water	X	B		X	X	X		X										
B-SW-08-U	na	Water		B	X				X											
B-SW-08-F	na	Water	X	B		X	X	X		X										
B-SW-09-U	na	Water		B	X				X											
B-SW-09-F	na	Water	X	B		X	X	X		X										
B-SW-10-U	na	Water		B	X				X											
B-SW-10-F	na	Water	X	B		X	X	X		X										
B-SW-11-U	na	Water		B	X				X											
B-SW-11-F	na	Water	X	B		X	X	X		X										
B-SW-12-U	na	Water		B	X				X											
B-SW-12-F	na	Water	X	B		X	X	X		X										
B-SW-13-U	na	Water		B	X				X											
B-SW-13-F	na	Water	X	B		X	X	X		X										
B-SW-14-U	na	Water		B	X				X											
B-SW-14-F	na	Water	X	B		X	X	X		X										

TABLE 4-4
SAMPLE TRACKING FORM

					Laboratory Parameters							Field Parameters									
Field Sample Identification	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd (SW6020A)	Dissolved Ca, Fe, Mg, V (SW6010B/C)	Dissolved Cl and SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)		Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (ºC)	Air Temperature (ºC)	Discharge (ft^3/sec)

ER - equipment rinsate blank sample, to be taken once per field team per day, total ERs taken may not add up to what is accounted for here
B – water blank sample, to be taken once per field team per day, in conjunction with ERs
ID - identification
na - not applicable
QC - quality control

5.0 PROJECT ORGANIZATION

5.1 PROJECT TEAM

The project team member information is presented below. Contact information for each member of the project team is presented in Table 5-1, *Project Contacts*. The field team leader will perform a thorough review of the day's field sampling forms and update the tracker table according to the day's activities (i.e., stations sampled with sample ID's and field parameters taken). This process will procure an extra step in the QA/QC process to help ensure every sample is taken and that nothing is missed.

Surface Water Sampling Project Team:

- Barry Koch – P4 Program Manager
- Paul Stenhouse – P4 Environmental Regulatory Specialist / Field Team Leader
- Cary Foulk – MWH Project Manager
- Colin Duffy – Program Safety Officer/Technical Support
- Dean Brame – Technical Support
- Ruth Siegmund – Program Quality Manager
- Celeste Christensen – Program Control
- Elaine Smith – Database Manager
- Edmund Ling – Project Chemist
- Microbac – Contracted Analytical Laboratory
- Laboratory Data Consultants (LDC) – Contracted Third Party Validation

TABLE 5-1 PROJECT CONTACTS			
Company or Agency	**Contact**	**Title**	**Telephone**
P4 Production	Barry Koch	Special Project Lead—Mining / Program Manager	208-547-1439
	Bob Geddes	Environmental Regulatory Specialist / Management Support	208-547-1234
	Paul Stenhouse	Environmental Regulatory Specialist / Field Team Leader	208-547-1294
Idaho Department of Environmental Quality	Mike Rowe	Program Manager and On Scene Coordinator	208-236-6160
MWH	Cary Foulk	Program Manager and Supervising Geologist / Geochemist	970-879-6260
	Bill Wright	Technical Support and Principal Ecologist	425-241-7413
	Ruth Siegmund	Program Quality Manager	925-627-4756
	Colin Duffy	Program Safety Officer / Technical Support	425-896-6907
	Dean Brame	Technical Support	425-896-6933
	Suzanne Anderson	Analytical Task Manager and Technical Support	425-896-6966
	Celeste Christensen	Project Coordinator	425-896-6969
	Edmund Ling	Project Chemist	925-627-4620
	Elaine Smith	Database Manager	925-627-4659
Microbac Laboratories, Inc.	Kathy Albertson	Project Manager (laboratory)	800-373-4071 x179
Laboratory Data Consultants, Inc	Linda Rauto	Project Manager (data validation subcontractor)	760-634-0437

5.2 PROJECT SCHEDULE

- Sampling –May/September 2009 and May/September 2010
- Data validation – within 60 days of receipt of laboratory data
- Data Summary Report – within 60 days of final, validated data set approval by the A/T or as agreed to for overall annual Data Summary Report.

5.3 PROJECT DELIVERABLES

The raw data and data validation reports will be submitted to the A/T when available. Once the validated sampling data are approved by the A/T, a Surface Water Sampling Data Summary Report will be submitted. This report will include:

- Field activity summary
- Data summary and detailed tables
- Figures presenting spatial distribution of data

- Statistical analysis of the data

This report may be incorporated within the overall Data Summary Report for the year's activities for the overall characterization project, or if the characterization component of the project is completed the data will be incorporated into the Site Investigation or Remedial Investigation report.

6.0 REFERENCES

IDEQ, 2009. Email communication: *P4 Monsanto – Surface Water Sampling for 2009.* Mike Rowe and Doug Tanner, IDEQ, January 16, 2009.

MWH, 2004. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan* – *Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program.* Prepared for P4 Production. March.

MWH, 2007. *2007 & 2008 Surface Water Monitoring Plans – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program.* Prepared for P4 Production. May.

MWH, 2009. *Final Quality Assurance Project Plan Addendum Program Quality Assurance Plan*. Prepared for P4 Production. May

Rantz, S.E., et al. 1982. *Measurement and Computation of Streamflow: Volume 1; Measurement of Stage and Discharge.* Geological Survey Water-Supply Paper 2175. U.S. Government Printing Office. Washington, D.C.

ATTACHMENT 1

MWH
MONTGOMERY WATSON HARZA

SOP-NW-9.1

Collection of Surface Water Samples

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

The purpose of this document is to define the standard operating procedures (SOP) for the collection and handling of surface water samples. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of surface water sampling and is intended for use in conjunction with site-specific workplans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with approval of the Project Manager or Task Leader and the Quality Assurance (QA) Manager. Sampling locations shall be as specified in the governing workplan or SAP.

2.0 RESPONSIBILITIES

2.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager, as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements.

2.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

2.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, sediment sampling forms, generated data, and other associated and pertinent project information.

2.4 QA Manager

The QA Manager is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or workplans.

3.0 DISCUSSION

The methods described by this procedure may be used to acquire water samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

4.0 PROCEDURES

The sampling methods described in this SOP are suitable for collecting water samples that are located at or near active and historic phosphate mines in the southeast Idaho project area. This SOP describes collecting surface water samples at four different types of water bodies, streams, seeps, reservoir or lakes, and standing water locations (ponds). Sample documentation and labeling, as well as, sampling frequency, locations, volumes and analyses shall be as specified in the governing workplan or SAP.

4.1 Decontamination

Before sampling at a new location, all water sample collection equipment will be decontaminated by rinsing the water collection equipment three times with source water, or as specified in the governing workplan or SAP.

4.2 Instrument Calibration

Electronic equipment used during sampling to obtain field parameters will include, but is not limited to, a pH meter with automatic temperature compensation, a specific conductivity meter, a dissolved oxygen meter, a turbidity meter, and an oxidation-reduction potential meter (ORP or eH). Before going into the field, the field team leader will verify that all equipment is operating properly. Calibration, times and appropriate readings will be recorded in the field notebook and as specified in the governing workplan or SAP. Meters will be calibrated according to manufacturer's instructions.

4.3 Filtering

Samples to be analyzed for dissolved state will be filtered during the field sampling event by using a disposable 0.45 micron filter apparatus and peristaltic pump, vacuum pump, syringe, or equivalent equipment. Other samples for a particular analysis may require filtering as specified in the governing workplan or SAP. Filtered samples will be collected according to the following procedure:

- Assemble filter device according to manufacturer's instructions.
- Filter sample either by pouring sample in the top portion of filter unit or pumping it through an in-line filter using the pump or syringe.

- Transfer filtered sample to appropriate sample bottle with required preservative.

- Dispose of the used filter and tubing.

- Decontaminate any reusable filtering equipment. Place decontaminated equipment in a clean plastic bag or container for transportation between sampling locations.

4.4 Obtaining Water Samples

The following general procedures will be used before collecting surface water samples:

- Describe physical characteristics of the water source to be sampled, including type (seep, pond, stream, reservoir, lake, etc.), any visual discoloration of water, odor, clarity, or any other notable characteristic of the water source.

- Collect field measurements of water quality parameters.

- Assemble all necessary sample collection and filtering equipment.

- Make sure that the sample labels have been correctly filled out for the sampling location. Assemble bottles for filling.

- Decontaminate sample collection equipment by rinsing the equipment three times with source water.

- Collect water sample. Ideally, the sample will be taken from a point away from where the rinsing of collection equipment occurred when sampling standing water or upstream of the rinsing point when collecting flowing water. The water collection container will be lowered into the water, taking care to avoid collecting items floating in the water and disturbing any sediment during sample collection. After the container is filled, carefully lift it out of the water and empty it into a clean sample composite container. Repeat the process at the sampling location until a sufficient amount of sample has been placed into the composite container as described below. The amount of sample to be composited shall be as specified in the governing workplan or SAP.

- Transfer to appropriately labeled containers

4.4.1 Seeps

Water samples will be collected by immersing the sample transfer container as described above, or for a raw sample, the sample container in the water source. This collection method results in a grab sample that characterizes the medium at a point in space and time, and assumes that the water body sampled (seep) is homogeneously mixed and has no stratification. Water sample collection from seeps will be done closest to the point of discharge as possible, to minimize contamination from surficial contact.

4.4.2 Ponds

Water samples will be collected by immersing the sample transfer container as described above, or for a raw sample, the sample container in the water source. This collection method results in a grab sample that characterizes the medium at a point in space and time, and assumes that the water body sampled (pond) is homogeneously mixed and has no stratification due to it's small size. Collecting water samples from standing water will have the emphasis placed upon the sampler not to disturb the water to be sampled, and the use of a swing sampler to collect as far from the shoreline as possible. This method will be especially important when collecting samples from ponds that have loose material and high gradient slopes that define the pond shoreline, which is typical of mine pit ponds. This will also be important to minimize the immersion risk of sampling personnel. Water samples for ponds may be collected from any point along the shoreline.

4.4.3 Streams and Rivers

Samples will be collected from the same cross section of the stream as that which is used for the discharge (flow) measurement, if discharge is measured. Samples will always be collected prior to making discharge measurements. The sampler will stand downstream of the water to be sampled if safe to do so. If sampling multiple stations on the same stream, downstream samples will always be collected first. Prior to sampling, the stream will be observed for any upstream activities or events that may affect the sample quality. If such events are occurring, the sample will not be collected until the stream clears and the occurrence will be recorded in the field notes.

Selection of sampling methods and equipment based on flow conditions is as follows:

- If the stream is less than 10 ft wide, the sample will be collected from the center of the flow at mid-depth.

- If the stream is greater than 10 ft wide, one composite, consisting of three samples will be collected. The water samples will be taken at ¼, ½, and ¾ of the distance across the river or stream cross-section. These samples should be taken at mid-depth in the water column at each location across the stream channel. All three samples will be composited into one larger container, and apportioned as necessary, into the appropriate sample containers.

Water will be collected from smaller streams and rivers using a standard Kemmerer or Van Dorn horizontal water bottle sampler with the field technician standing downstream and to the side of the bottle. The sampler is a plastic cylinder with rubber stoppers that leave the ends open while being lowered to allow free passage of water through the cylinder. The Kemmerer horizontal water bottle sampler may need to be lowered on a line to reach the desired depth. Once the sampler reaches the desired depth, a 'messenger' is sent down the line, causing the stoppers to close the cylinder, which is then raised. In shallow and faster moving streams and rivers, operation of the Kemmerer horizontal water bottle sampler will be done by hand, and not with a ‘messenger’. The water inside the sampler will then be transferred to a clean composite container. The process will be repeated at the sampling location until a sufficient amount of sample has been placed into the composite container. When a sufficient amount has been collected, transfer the water from the composite container into the appropriate sample containers. If unsafe wadding conditions exist (i.e., deep water, fast flowing water, slippery surfaces, etc.) a swing sampler will be utilized instead of the horizontal water bottle sampler to collect sample water for compositing. The method of sample collection shall be recorded in the field notebook.

4.4.4 Reservoirs and Lakes

Each lake and/or reservoir sample consists of collecting and compositing samples at several depths along a vertical profile using a standard Kemmerer or Van Dorn horizontal water bottle sampler. This collection method results in a vertically composited sample that characterizes the medium at a point in space and time, and takes into account the possibility of the water body sampled (i.e., reservoir or lake) is not homogeneously mixed and may be stratified. The sampler is a plastic cylinder with rubber stoppers that leave the ends open while being lowered to allow free passage of water through the cylinder. Once the sampler reaches the desired depth, a ‘messenger’ is sent down the line to cause the stoppers to close the cylinder, which is then raised. The water inside the sampler will then be transferred to a clean composite container. Repeat the process at the sampling location until a sufficient amount of sample has been placed into the composite container. When a sufficient amount has been collected, transfer the water from the composite container into the appropriate sample containers. A boat shall be utilized to collect samples from reservoirs and lakes.

4.5 Sampling Documentation

A field sampling data sheet will be completed at each sample location. Items not applicable to the sampling will be labeled as not applicable (NA). Sampling information will also be recorded in a bound field notebook. The information recorded on the data sheet and in the field notebook will include the following:

- Sampling location
- Date and time of sampling
- Persons performing the sampling
- Field water quality parameter measurements (specific conductivity, temperature, dissolved oxygen, pH, oxidation-reduction potential, etc.)
- Physical description of the water body to be sampled (color, odor, etc.)
- Sample identification numbers
- Number of samples taken- note containers, analytes, filtering and preservation methods
- Identification numbers of any QC samples from the site
- Any irregularities or problems which may have a bearing on sample quality

4.6 Equipment List

Sample bottles and preservatives (ultra-pure or metal grade nitric acid) will be obtained from the laboratory selected to perform the chemical analyses of the samples. Extra sample bottles with appropriate preservatives will be obtained in case of breakage or other problems.

Equipment used during surface water sample collection includes:

- Camera
- Chain of custody
- Coolers with ice/blue ice
- Copy of this SOP, SOP-NW-9.2 and -9.2a (if applicable) and the governing workplan or SAP
- Dissolved oxygen meter
- Filtering apparatus with disposable 0.45 micron filters
- GPS unit
- Hand pump, peristaltic pump, vacuum pump, or equivalent equipment
- Oxidation-reduction potential meter
- Plastic HDPE sample pitcher
- Plastic squeeze bottle filled with distilled water
- Plastic trash bags
- pH/eH meter (with automatic temperature compensation)
- Rope if obtaining deep samples
- Rite-in-the-Rain™ field notebook
- Sample containers that are certified clean
- Sample labels
- Specific conductivity meter
- Strapping and clear tape
- Swing sampler
- Kemmerer or Van Dorn horizontal water bottle sampler
- Suitable HDPE 5 L container
- Turbidity meter
- Silicon tubing
- Wooden stakes
- Writing instruments
- Measuring tape

The governing workplan or SAP may require the use of other equipment based on the scope and objective of an individual project. Project personnel will review the workplan or SAP for any equipment not listed in this SOP.

4.7 Field Quality Assurance/Quality Control Samples

Field QA/QC sample requirements shall be as specified in the governing workplan or SAP.

4.8 Sample Containers

All sample bottles must be properly cleaned and prepared. Coordinate with selected analytical laboratory for appropriate sample bottle types and preparation requirements. Plastic, such as PVC, polyethylene, polypropylene, and Tygon, is an acceptable material for contacting samples when the analyses are for inorganic analytes (metals, radionuclides, anions, and cations). Stainless steel and fluorocarbon resin (Teflon, PTFE, FEP, HDPE, or PFA) are acceptable materials that may contact surface water samples. Glass is an acceptable material for contacting samples except when silica or fluoride analyses are to be performed.

4.9 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing workplan or SAP. Typical handling procedures for surface water samples are as follows:

- Store sample containers in coolers for transportation in compliance with the sample handling and chain of custody requirements specified in the workplan or SAP.

- Sample documentation and labeling requirements shall be as specified in the governing workplan or SAP.

All surface water samples shall be labeled and sealed and immediately placed in ice-filled coolers with securely closed lids for storage and transport. The analytical laboratory must receive samples in sufficient time to conduct the requested analyses within the specified holding time.

During surface water sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan, to minimize cross-contamination and to ensure the safety of the field sampling personnel.

SURFACE WATER SAMPLE COLLECTION FORM

Project:____ **Project Number:** ________________

Date: ______/_____/______ **Time:** ______________

Field Personnel: __________________________ **Signatures:** __________________________

__________________________ __________________________

SITE DESCRIPTION

Site Location: ____ **Elevation**________________

Station Number: _______ **Photo No.:** ________________ **Roll No.:** ___________

GPS Coordinates: **Latitude**______°_______´_______´´ **Longitude**______°_______´_______´´

Comments/Descriptions:____

FIELD DESCRIPTION

Sample Identification Number: _______________________________________

Surface Water Characteristics (color, odor, appearance): _________________________________

____

Collection Method: **Grab, Kemmerer**____

Field Measurements

Parameter	Reading/Measurement			Initials	Remarks
	Sample 1	Sample 2	Sample 3		
Air Temperature (°C or F)					
Specific Conductivity (mhos) @ 25° C					
Conductivity					
Dissolved Oxygen (mg/L)					
pH					
Oxidation-Reduction Potential (ORP)					
Turbidity (FTU)					
Water Temperature (°C)					

MWH
MONTGOMERY WATSON HARZA

SOP-NW-9.2a

Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

This Standard Operating Procedure (SOP) provides general techniques for obtaining valid, representative flow measurements from natural open-channels using estimation techniques or man-portable devices. Direct methods for flow measurements in open channels using weirs, flumes, or other devices and direct and indirect flow measurements in pipes are provided in SOP-NW-9.2, *Surface Water Flow Measurements.* This SOP applies to any work performed by MWH or subcontractor personnel for any portion of stream flow measurements and is intended to be used in conjunction with governing work plans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approved by the Project Manager or Task Leader and the Quality Assurance (QA) Manager.

Stream flow measurement methods in this SOP assume the following conditions:

- No control structures will be used for flow measurements at surface water stations;
- A current meter will be the preferred method for discharge measurements; and
- A few locations may be appropriate for engineering estimates or volumetric measurement.

2.0 DEFINITIONS

Discharge is defined as the volume rate of flow of water, expressed in cubic feet per second (cfs), including any substances suspended or dissolved in the water. Methods for measuring discharge are based on a variety of flow conditions. Many discharge measurement methods are required because flow conditions differ from site to site.

3.0 RESPONSIBILITIES

3.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for field testing, total and accurate completion of data sheets, and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements.

3.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that stream flows are measured as specified in project work documents and this technical procedure.

3.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, surface water flow measurement forms, generated data, and other associated and pertinent project information.

3.4 QA Manager

The QA Manager is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or work plans.

4.0 DISCUSSION

The methods described by this procedure may be used to measure flow in open channels. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or work plans.

Because of the dynamic nature of surface water behavior, flow measurement by the methods described in this document may, on occasion, be impossible at some sites. It is understood that if unmeasurable flow conditions are encountered at any of the surface water data collection sites which are to be measured in this program, the field team will attempt to measure flow at a point upstream or downstream of the site and will note this point relative to the marked data collection point in the field logbook. Whether or not a measurement is made, the team will note the conditions that inhibited accurate flow measurement. This situation will be brought to the attention of the MWH Project Manager and QA Manager using the field change protocol established in the governing workplan or SAP.

5.0 PROCEDURES

5.1 Velocity-Area Method

Surface flow in stream channels that are greater than one foot wide, or where flow is estimated to exceed 2.0 cfs, will be measured by using the traditional stream gaging technique, the velocity-area method.

When using the velocity-area method to perform discharge measurements of flowing surface water streams, a current meter will be used. The most common current meters are vertical axis meters, such as the Price meter Type AA, and horizontal axis or propeller-type meters. The standard Price meter has a rotor 5 inches in diameter and 2 inches high with six cone-shaped cups mounted on a stainless steel shaft. A pivot bearing supports the rotor shaft. In addition to the type AA meters, a Price pygmy meter is used in shallow depths. The pygmy meter is scaled two-fifths as large as the standard meter and has no tailpiece. Propeller-type current meters employ a propeller turning about a horizontal axis. Variable flow conditions may require the use of the pygmy meter, the Price AA meter, or a propeller-type meter, depending on the amount of runoff contributing to streamflow.

5.1.1 Theoretical Considerations

The volume rate of flow of water, which is commonly called discharge (Q), is the product of multiplying the average velocity (V) times the total cross-sectional area (A):

$$Q = V * A$$

The current meter measures velocity at a point. The velocity-area method of making discharge measurements at a cross-section requires measurement of the mean velocity in multiple portions of the cross-section at each of the selected verticals. These are taken at subsections of the cross-section. A complete discussion of area-velocity methods is found in *Measurement and Computation of Streamflow: Volume 1 - Measurement of Stage and Discharge* (Rantz, 1982)

By dividing the stream width into subsections, total discharge becomes the total of discharges measured in each subsection. Velocity (v) is estimated using the two-point method, or for shallow streams, the six-tenths-depth method, measured at each subsection. The two-point method consists of measuring the velocity at 0.2 and then at 0.8 of the depth from the water surface, and using the average of the two measurements. For streams shallower than 2 feet, the six-tenths-depth method will be used. The six-tenths-method consists of measuring the velocity at 0.6 of the depth from the water surface.

Discharge becomes the sum of the products of each point velocity and cross-sectional area of each subsection:

$$Q = \Sigma (v * a)$$

where:

Q = total discharge (in cubic feet per second),
v = point velocity (feet per second), and,
a = area of the subsection (square feet).

In measuring discharges for developing stream ratings for litigation and flood-plain insurance purposes, federal agencies typically base the number of subsections on the criterion that each subsection contain no more than 5 percent of the total discharge. While this method has reportedly resulted in measurement accuracy as high as 98 percent, factors such as the characteristics of the measurement section reduce this accuracy. Furthermore, measurements limiting flow to 5 percent of the total discharge are time-consuming. Therefore, in the interests of conserving time while maximizing measurement accuracy, current-meter measurements performed in channelized streams will be based on selecting subsections to contain approximately 10 percent or slightly more of the total discharge. However, the stream should not be partitioned into sections that are significantly greater than 10 percent of the total stream flow because individual measurements that may be in error will then have a significant impact on the overall average velocity determination.

In general, depending on average depth and velocity distribution, a stream less than 2 feet wide will require no more than 8 to 10 subsections. A stream up to 4 feet wide will require about 10 to 12 subsections. Streams wider than 4 feet will require more subsections. Further, subsections need not be of identical width. For example, because velocities near banks are generally lower than velocities near the center of streams, these subsections may be wider than subsections near the center. Subsections will also be more closely spaced if a stream has an unusually deep portion in the cross-section, or if velocities are higher than usual for the cross-section.

Velocity will be observed by current meter at each point for a period that ranges from 40 to 70 seconds.
The stage of a stream is the height of the water surface above an established datum plane. The water-surface elevation referred to is an arbitrary gage datum called the "gage height." Stage or gage height is to be measured and recorded in feet and tenths of a foot.

5.1.2 Required Measurement Conditions

In order to make a velocity-area discharge measurement using a flowmeter, the following conditions are required:

- The stream must be channelized: that is, observable banks must channel the stream flow;
- Depth must be greater than 0.2 foot across most of the cross-section being measured; and
- The stream must have measurable velocity of at least 0.2 feet per second in most of the

cross-section, although the pygmy meter is capable of measuring velocity as low as 0.070 feet per second.

The first two conditions can often be met in streams of very low discharge by conservatively modifying the stream channel to produce a narrower and slightly deeper cross-section in order to meet measurement requirements. These modifications will include removal of aquatic growth or ice, moving large stones which impact velocity upstream or downstream of the cross-section, and narrowing or deepening of the cross-section. By rearranging small amounts of native rock or sand, the technician will produce a measurable cross-section. When such modifications are made, great care will be exercised to avoid unnecessary movement of sediments or the splashing of sediments or water onto field team members. After clearing the cross-section, flow will be allowed to stabilize before the current-meter measurement of velocities begins.

If depths of 0.2 feet or greater cannot be found or made, the velocity will be estimated by recording the time required for a floating object to cover a known length of the stream. The object velocity will be calculated by multiplying the fixed distance with the average stream area and a correction factor of .9 and dividing by the recorded time. At a minimum, three separate trials will be completed and a mean object velocity calculated.

Current meter measurements are best made by wading, if conditions permit. The Price AA, Pygmy, or propeller-type meters are used for wading measurements. Vertical axis current meters do not register velocities accurately when placed close to a vertical wall. A Price meter held close to a right-bank vertical wall will under-register because the slower water velocity near the wall strikes the effective (concave) face of the cups. The converse is true at a left-bank vertical wall. (The terms "left-bank" and "right-bank" designate direction from the center of a stream for an observer facing downstream). The Price meter also tends to under-register when positioned close to the water surface or close to the streambed.

5.1.3 Equipment

Current meters, timers, depth and width measuring devices, and a means of counting meter revolutions are needed for measurement of discharge. The equipment includes:

- Depth-measuring device
- Current meter
- Width-measuring devices, either engineer's tape or tagline
- Stopwatch
- Marker

Depth-Measuring Device. The depth-measuring device may consist of a graduated rod or staff in feet and tenths. If a Price-type meter is used, the depth-measuring device will be the topsetting 2-inch diameter hexagonal wading rod.

Current Meter. A current meter is an instrument used to measure the velocity of flowing water. The principle of operation is based on the proportionality between the velocity of the water and the resulting angular velocity of the meter's rotor. By placing the current meter at a point in a stream and counting the number of revolutions of the rotor during a measured interval of time, the velocity of water at that point is determined.

Engineer's Tape or Tagline. Steel tapes, metallic tapes, or premarked taglines are used for width determinations during discharge measurements made by wading. Direct measurement of width using tapes or taglines can be accurate with proper precautions. Orientation normal to the flow pattern of the river and elimination of most of the sag, through support or tension, are recommended for improved accuracy.

Stopwatch. A stopwatch is used to measure time during which velocity is measured at each point in the cross-section. Velocity at each point is measured for a period greater than or equal to 40 seconds and less than or equal to 70 seconds.

Marker. Each location where the velocity-area method will be consistently applied will be marked with a field stake.

If a Price meter is used, additional equipment includes a headset. A headset attaches to an electronic connection at the upper end of the wading rod.

5.1.4 Maintenance and Calibration Procedures

Prior to use of the current meter and following use of the meter, tests will be conducted to ensure that the unit performs acceptably. For Price-type and propeller-type meters, calibration tests will be conducted prior to and after fieldwork. Calibration tests will be conducted in streams fitted with Parshall flume or equivalent measurement device. Stream velocities derived from flume readings will be compared to the meter readings.

In addition, for Price-type meters, spin tests will be conducted. The spin test will be performed in an enclosed area, such as in the cab of a truck or in the enclosed rear of a truck, to prevent wind interference. The test is to be performed prior to attaching the current meter to the wading rod. While holding the meter steady in an area sheltered from breezes, the technician will spin the rotor and then press the start button on the stopwatch. The technician will observe the meter until the rotor ceases to spin. The duration of the spin for the pygmy meter should be more than 40 seconds and for the Price AA meter should be more than 90 seconds. If the meter fails to meet the time-of-spin criteria, the meter will be cleaned and oiled before use. If the meter continues to spin well beyond these time limits, the record will indicate that the meter spun for 40+ seconds, in the case of the pygmy meter, or for 90+ seconds, in the case of the Price AA meter.

To ensure reliable observations of velocity, it is necessary that the selected current meter be kept in good condition. Before and after each discharge measurement, meter cups, vanes, or propellers, pivot and bearing, and shaft should be examined for damage, wear, or faulty alignment. During measurements, the meter will be observed periodically when it is out of the water to be sure that the rotor or propeller spins freely.

Meters will be cleaned and, if applicable, oiled daily when in use. If measurements are made in sediment-laden water, the meter will be cleaned immediately after each measurement. After cleaning and lubrication, the rotor or propeller will be spun to make sure that it operates freely. If the rotor or propeller stops abruptly, the cause of the trouble will be sought and corrected before using the meter.

In addition to meter maintenance, the entire meter unit will be checked before departure to the field each day as follows:

- For Price-type meters, attach the current meter and digital counter/headset to the wading rod. Test the headset by:

    1. Spinning the current meter to ensure that audible clicks occur.
    2. If audible clicks do not occur, the following steps should correct the problem:

        - Check that electronic connections are tight;
        - Check that the cat's whisker lightly contacts the upper part of the shaft;
        - Spin again and if audible clicks still do not occur, check that the battery in the headset is properly aligned. Replace the battery, if necessary.

- For propeller-type meters, activate the sensor and test by:

    1. Moving the propeller through the air to ensure that electronic readings are displayed.
    2. If no display is visible, the following steps should be completed:

        - Check that the batteries have power. Replace if necessary;
        - Check that sensor and display are connected to the shaft wire.

5.1.5 General Considerations

Based on approximate depths, either the Price-type or propeller-type meter will be used to perform a velocity-area measurement. If depths or velocities under natural conditions are too low for a dependable current meter measurement, the cross-section will be modified, if practical, to provide acceptable conditions. A shovel will be used to remove aquatic vegetation, ice, or rocks that may interfere with meter operation or discharge measurement.

At each measurement point (or station) across the stream cross-section, depth is measured prior to measurement of velocity. Therefore, it is recommended that the measuring rod be set with the current meter suspended out of the water and above the tagline, which is used to measure width and to identify stations across the cross-section. Placement of the rod about 0.5 feet downstream from the tagline prevents contact between the tagline and the current meter when the meter is lowered into measuring position. The measuring rod will be placed in the stream so the base rests on the streambed, and the depth of water will then be read from the graduated main rod. The main rod is graduated into 0.l-foot increments.

The meter operator reads water depth directly from the depth-measuring rod. In high velocity areas, it is recommended that depth be read as the value between the depth on the upstream side of the rod and the depth on the downstream side of the rod. Depth is measured to the nearest 0.02 foot. This depth is used to set the vertical location on the current meter.

The meter operator will stand in a position that least affects the velocity of the water passing the current meter. The meter operator will face upstream while holding the depth-measuring rod vertically and close to the tagline or measuring tape. The meter operator stands at about a 45-degree angle downstream from the measuring rod and at least 1.5 feet from the depth-measuring rod. This angle is an imaginary angle between the extended arm holding the depth-measuring rod and the tagline or measuring tape. The meter operator should avoid standing in the water if his or her feet and legs occupy a significantly large percentage of a narrow cross-section. For narrow streams, it is often possible to stand astride the stream.

The depth-measuring rod should be held in a vertical position with the meter parallel to the direction of flow while the velocity is being observed. When measuring streams that have shifting beds, the soundings or velocities can be affected by the scoured depressions left by the hydrographer's feet. For such streams, the meter should be placed ahead of and upstream from the operator’s feet.

5.1.6 Discharge Calculations

A stream discharge is the summation of the products of the subsection areas of the stream cross-section and their respective average velocities. The formula $Q = \Sigma (v * a)$ represents the computation, where Q is the total discharge, a is an individual subsection's area, and v is the corresponding mean velocity of flow normal to the subsection. The summation of the discharges for all the subsections is the total discharge of the stream. The order for calculating discharge is:

- Use the distances from initial point to compute width for each section. The first width is computed by subtracting the first distance from the second distance, and dividing this quantity by two. The second width will be the quantity of difference between the third distance and the first distance, divided by two. For each subsequent width, subtract the distance on the line above the line you are calculating from the distance on the line below the line you are calculating, and divide this quantity by two. This procedure is carried out for each line until you reach the final width calculation. This is calculated as the quantity of the difference between the final distance and the second-to-the-last distance, divided by two.

- Subsequent calculations will be performed as follows:

  - Calculate each discharge for each subsection by multiplying the width of the subsection times the depth times the velocity.

  - Sum the discharges for each subsection to arrive at total discharge for the entire cross-section.

- Check your math by summing the subsection widths. Their total should equal the value obtained by taking the difference between the left and right bank station distances from initial point.

- Initial at the line "Comp. by" to identify yourself as the person responsible for performing the discharge calculation.

5.2 VOLUMETRIC METHOD

The volumetric method is a simple and accurate method for measuring flow from small discharges such as gravity flow discharges from pipe outlets.

5.2.1 Theoretical Considerations

This method involves measuring the time required to fill a container of known capacity, or the time required to partly fill a calibrated container to a known volume. Alternatively, in the case of measuring discharge remotely in a sump or standpipe setting, the volumetric method may be performed by capturing flow in a container for a set period of time. This volume of water is then measured and discharge is determined.

5.2.2 Required Measurement Conditions

Conditions must be such that all discharge from an outlet can be captured in the volumetric container during the period of measurement.

5.2.3 Equipment

The bucket and stopwatch technique is particularly useful for the measurement of small flows. Equipment required to make this measurement is a calibrated container and a stopwatch. Calibrated containers of varying sizes will include:

- 5-gallon bucket
- 2-liter graduated cylinder
- 1-liter graduated cylinder
- 1-liter bucket
- 500-milliliter beaker
- 250-milliliter beaker

5.2.4 Maintenance and Calibration Procedures

Graduated cylinders are incremented in terms of milliliters and can be easily converted to gallons. The incremental volume of a 5-gallon bucket can be determined by adding known volumes of water and recording the depth after each addition.

5.2.5 General Considerations

Upon arrival at the site, the sampling personnel will evaluate the flow conditions to select the appropriate method for flow measurement. If flow conditions are appropriate for volumetric measurement, the sampling personnel will observe and use judgment in approximating the flow volume and will select an appropriately sized volumetric container.

Sampling personnel will use a stopwatch to measure the time required to fill a volumetric container. The sampler will time flow into the container for a minimum of 10 seconds. Three consecutive measurements will be made and noted, and the results will be averaged to determine the discharge.

5.2.6 Discharge Calculations

Discharge will be determined initially in gallons per second (gal/s) or in milliliters per second (ml/s). These values will be noted, but the average value will be reported in cubic feet per second. Calculations will be performed as follows:

- Record each of the three measurements in terms of gallons per second or milliliters per second, depending on the volumetric container.

- If one of the three measurements is 50 percent or more different from the other two measurements, then this value will not be used. Instead, three additional measurements will be taken and, provided that none of these three measurements differs by greater than 50 percent from the other two measurements, these values will be used.

- Average the three values.

- Convert the averaged value to cfs as follows:

  - To convert ml/s to cfs, multiply by 3.5. x 10^{-5}

  - To convert gal/s to cfs, multiply by 0.134

- Record discharge in cfs.

6.0 REFERENCES

Linsley R.K, Kohler, M.A., Paulhus, J.L.H. 1982. *Hydrology for Engineers*. McGraw-Hill Book Company. New York, N.Y.

Rantz, S.E., et al. 1982. *Measurement and Computation of Streamflow: Volume 1; Measurement of Stage and Discharge*. Geological Survey Water-Supply Paper 2175. U.S. Government Printing Office. Washington, D.C.

Rantz, S.E., et al. 1982. *Measurement and Computation of Streamflow: Volume 2: Computation of Discharge*. Geological Survey Water-Supply Paper 2175. U.S. Governmental Printing Office. Washington, D.C.

Robertson, J.A., Cassidy, J.J., and Chaudhry, M.H. 1988. *Hydraulic Engineering*. Houghton Mifflin Company. Boston, MA

APPENDIX B– HEALTH AND SAFETY PLAN

INACTIVE MINES SITE INVESTIGATION

HEALTH AND SAFETY PLAN

DRAFT
Revision 2

April 21, 2009

This page was intentionally left blank.

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
2.0 SITE HEALTH AND SAFETY ANALYSIS 2-1
2.1 POTENTIAL CHEMICALS HAZARDS 2-1
2.2 RADIOLOGICAL HAZARDS 2-3
2.3 PHYSICAL HAZARDS 2-3
2.4 BIOLOGICAL HAZARDS 2-6
3.0 ASSIGNMENT OF RESPONSIBILITIES 3-1
3.1 VICE PRESIDENT-IN-CHARGE 3-1
3.2 PROJECT MANAGER 3-1
3.3 PROGRAM SAFETY OFFICER 3-2
3.4 ON-SITE SAFETY OFFICER 3-3
3.5 FIELD TEAM LEADER 3-4
3.6 FIELD PERSONNEL 3-5
3.7 SITE VISITORS 3-5
4.0 PERSONNEL TRAINING 4-1
4.1 INITIAL SITE-SPECIFIC HEALTH AND SAFETY TRAINING 4-1
4.2 TAILGATE SAFETY MEETINGS 4-3
4.3 BLOODBORNE PATHOGENS AND FIRST AID/CPR 4-3
4.4 DOCUMENTATION OF TRAINING 4-3
5.0 MEDICAL SURVEILLANCE 5-1
6.0 PERSONAL PROTECTIVE EQUIPMENT 6-1
6.1 PERSONAL PROTECTIVE EQUIPMENT 6-1
6.2 LEVEL D PERSONAL PROTECTIVE EQUIPMENT 6-2
6.3 PPE STORAGE 6-4
7.0 HAZARD ASSESSMENT 7-1
7.1 HEAT STRESS 7-1
7.2 COLD STRESS 7-2
7.2.1 Frostbite Monitoring 7-2
7.2.2 Hypothermia Monitoring 7-3
8.0 SITE CONTROL 8-1
8.1 MULTIPLE-EMPLOYER JOB SETTING 8-1
8.2 SITE SECURITY 8-1
8.3 COMMUNICATION SYSTEMS 8-2
9.0 DECONTAMINATION PROCEDURES 9-1
9.1 GENERAL DECONTAMINATION PROCEDURES 9-1
9.2 DECONTAMINATION WASTE HANDLING AND DISPOSAL 9-1
10.0 EMERGENCY RESPONSE PLANNING 10-1
11.0 HEALTH AND SAFETY DOCUMENTATION 11-1
12.0 GENERAL SITE SAFETY 12-1
12.1 GENERAL HEALTH AND SAFETY PROGRAM ELEMENTS 12-1
12.1.1 Hazard Communication Program 12-1
12.1.2 Sanitation 12-2
12.1.3 Illumination 12-2

12.1.4 Standard Emergency Hand Signals ... 12-2
12.1.5 Fire Protection ... 12-3
12.1.6 Earthquake and Disaster Preparedness ... 12-6
12.2 COMMON PHYSICAL HAZARDS AND CONTROLS ... 12-6
12.2.1 Slip/Trip/Fall ... 12-6
12.2.2 Heavy Lifting ... 12-7
12.2.3 Motor Vehicle Hazards ... 12-7
12.2.4 Sharp Edges and Pinch Points ... 12-7
12.3 SEVERE WEATHER ... 12-7
12.3.1 Lightning ... 12-7
12.3.2 Tornadoes ... 12-8
12.3.3 Winter Storms ... 12-8
12.4 ENGINEERED CONTROLS ... 12-9
12.5 ADMINISTRATIVE CONTROLS ... 12-9

LIST OF TABLES

Table 2-1 Occupational Exposure Limits and Toxicological Properties for Potential Chemical Exposure Hazards
Table 2-2 Ten Essentials for Wilderness Travel
Table 3-1 Project Health and Safety Program Contact List

LIST OF FIGURES

Figure 3-1 Project Organization Chart
Figure 6-1 Sample Protective Equipment Ensembles

LIST OF APPENDICES

Appendix A	Activity Hazard Analysis
Appendix B	Emergency Contacts
Appendix C	Personal Acknowledgement Form
Appendix D	Pre-Job Risk Analysis Worksheet
Appendix E	Occupational Incident Report Forms & Procedures
Appendix F	OSHA Job Safety and Health Protection Poster
Appendix G	Monsanto Contractor/Guest ES&H Site Guidelines
Appendix H	Degerstrom Ore Haulroad Travel Requirements
Appendix I	MWH EH&S Procedure No. 811, Drilling Safety
Appendix J	MSDSs
Appendix K	Portable Generator Hazards

ACRONYMS AND ABBREVIATIONS

ACGIH	American Congress of Governmental Industrial Hygienists
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CPR	Cardiopulmonary Resuscitation
EPA	Environmental Protection Agency
ft	Feet
FTL	Field Team Leader
HSP	Health and Safety Plan
IDLH	Immediately Dangerous to Life or Health
IMASC	Idaho Mining Association Selenium Committee
JRA	Pre-Job Risk Analysis
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NPS	National Parks Service
OSHA	Occupational Safety and Health Administration
OSO	On-Site Safety Officer
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
PSO	Project Safety Officer
REL	Recommended Exposure Limit
SOP	Standard Operating Procedure
TLV	Threshold Limit Value
TWA	Time-Weighted Average
yds	Yards

This page was intentionally left blank.

1.0 INTRODUCTION

This Health and Safety Plan (HSP) has been prepared to establish the responsibilities, requirements, and procedures for protecting MWH personnel during the P4 Production Inactive Mines Site Investigation. This HSP has been prepared to provide assigned field personnel with a safe working environment as the investigation proceeds. Specifically, the HSP has been developed to minimize the potential for job-related injuries and illnesses, and to prevent job-related injuries and illnesses from occurring. Where this HSP addresses safe practices for various specific construction activities, this information is provided solely as directives or guidelines for protecting MWH employees and establishing minimum requirements for MWH subcontractors. Any questions over implementation of this plan should be addressed to the Project Safety Officer or the MWH Regional EH&S Manager. See table 3-1 for complete contact list.

A fundamental principle of industrial safety and loss prevention is that most accidents that cause injury, illness, or property damage are preventable. Investigations of the causes of industrial accidents and illnesses have demonstrated that most injuries or illnesses are the result of unsafe acts or conditions. Thus, minimizing industrial accidents and illnesses can be accomplished by recognizing, evaluating, and controlling unsafe acts and conditions.

Employees are required to employ safe work practices and comply with applicable MWH requirements, as well as the applicable requirements of the agencies responsible for regulating industrial health and safety, including the OSHA and MSHA. Furthermore, P4 Production employs its own practice of training every contractor that works on the Soda Springs Phosphate Mine site to ensure that everyone on the site is knowledgeable and aware of the hazards that exist. This process and the applicable documents are discussed where applicable in this HSP.

2.0 SITE HEALTH AND SAFETY ANALYSIS

This section of the HSP identifies activity-specific hazards that may be encountered at project sites during the course of planned field activities, as well as methods that will be employed to control exposure to these hazards. The field activities discussed herein include the collection of soil, vegetation, surface and groundwater samples, well installation supervision, and the direct push program. Note that from this point forward, the *direct push program* will be implied whenever *wells* are discussed, but may not be mentioned by name. Activity locations will generally be either on or adjacent to P4 Production's phosphate mines. Exceptions may include a regional background sampling location at some range from the P4 mines.

Some of the selected sample sites are readily accessible by vehicle; others, however, are not directly accessible by vehicle, and may require travel on foot. Health and safety issues that are associated with these sites requiring extensive foot travel will be addressed herein.

Specific activities that may be involved in the investigation are listed in Appendix A, *Activity Hazard Analysis;* Appendix A details the hazards that may be associated with these activities, and recommended controls to minimize risk to MWH and subcontractor field personnel. Appendix I, *MWH EH&S Procedure No. 811, Drilling Safety,* addresses, in detail, hazards and safety concerns related to well installation and drilling supervision. Recognized specific chemical, radiological, physical, and biological hazards that may be encountered during field activities are also discussed in the following paragraphs.

Although phosphate ore bodies are known to have slightly elevated concentrations of Uranium-238 (^{238}U), radiation has not been identified as a hazard that is likely to be associated with this project and monitoring for ionizing radiation will not be undertaken during the investigation. Additional safety practices more generally applicable to field activities are summarized in the subsequent sections of this plan.

2.1 POTENTIAL CHEMICALS HAZARDS

The hazards that may be associated with chemical contaminants can be assessed through comparison of measured or estimated personnel exposures to established occupational exposure limits. PELs are established by OSHA, while RELs are established by NIOSH. IDLH concentrations are also established by NIOSH. TLVs and TWAs are established by the ACGIH. PELs may be expressed as an 8-hour TWA or as a ceiling limit. Ceiling limits may not be exceeded at any time, and are enforceable by law. RELs are published guidelines that set employee exposure limits for airborne contaminants. RELs are expressed as a TWA or ceiling limit. The ACGIH TLV/TWA is the airborne concentration of a substance to which nearly any worker may be repeatedly exposed 8 hours per day, 40 hours per week, without experiencing adverse health effects. For some substances, the overall exposure to a substance is aggravated by contact with skin, mucous membranes, or the eyes. Other substances have a ceiling value that may not be exceeded during any part of the workday. An IDLH concentration is the maximum airborne concentration of a substance that one could escape within 30 minutes without impairing symptoms or irreversible health effects. It is not anticipated that MWH personnel will be exposed to airborne contaminants above regulatory limits if prudent work practices, including dust control, are employed during the sampling event(s).

Extensive sampling has been undertaken in many areas of the Southeast Idaho Phosphate Resource Area to date by MWH and P4 Production, the IMASC companies, and regulatory agencies. Based on area history, the events that prompted this investigation, and sampling to date, naturally-occurring selenium, cadmium, molybdenum, and other trace elements in the phosphate ore body could potentially pose a hazard to sub-populations. Empirical evidence and evaluation of existing data indicate that there has been, and is no, reasonable possibility for health hazards to local residents. Such residents (who are assumed to consume exposed fish, game, and cattle) have high degrees of exposure—speaking relatively, rather than absolutely. Exposures to employees implementing the scope of work covered by this plan are substantially less and thus, there is no reasonable possibility for employee exposure to safety or health hazards associated with these substances. Table 2-1 presents occupational exposure limits and toxicological information for selenium and for other metals that could be present at the sampling sites.

In addition to the naturally occurring elements discussed above, field personnel will use a variety of chemical standards in the calibration of their field instruments. These include solutions for calibrating: conductivity (potassium chloride), pH-4, pH-10, oxidation-reduction potential or ORP (potassium chloride, potassium ferrocyanide trihydrate, potassium ferricyanide), and a calibration check (Quick Cal™) solution (potassium dihydrogen phosphate, potassium chloride, sodium hydroxide, potassium ferrocyanide trihydrate, potassium ferricyanide). These chemicals are generally non-toxic and non-corrosive, but nitrile gloves and safety glasses should still be worn when handling. All MSDSs can be found in Appendix J.

Field Personnel also are in contact with small (but still dangerous) amounts of nitric acid used for sample preservation in water samples. Nitrile gloves and safety glasses should ALWAYS be used, and extreme care should always be taken when opening sample bottles; at high altitudes, bottles can become pressurized and acid can be released violently when opened. Nitric acid is an extremely corrosive oxidizer and will cause severe burns to skin and even clothing. Fumes are toxic and employees should therefore avoid breathing in fumes directly.

Field measurements of nitrite and ferrous iron in groundwater samples require the use of chemical reagent packets. Nitrite reagents are composed of a variety of compounds, predominantly potassium phosphate, and ferrous iron reagents are composed of 1,10 – phenanthroline and sodium bicarbonate. Nitrile gloves and safety glasses must be donned while using either reagent.

When field equipment must be used that is not station-dedicated (i.e. the use of trowels and scissors during soil and vegetation sampling), equipment must be decontaminated with a water-Alconox™ detergent solution between uses. No safety hazards are anticipated when handling the solution, but when concentrated Alconox™ powder is handled, nitrile gloves and safety glasses should be used and caution should be taken.

During well installation, there is the possibility of hydraulic fluid/oil leaks or spills from drill rigs. MWH personnel must ensure that drilling contractors are capable of containing the release in such an event. Drillers often use liquid “drilling detergent” to increase the viscosity of the drilling fluid (typically water). Drillers typically use Dawn™ liquid dishwashing soap. While this is a relatively safe household item, safety glasses should be worn in the case of splatter.

2.2 RADIOLOGICAL HAZARDS

Phosphate ore in the southeast Idaho Phosphate Resource Area has slightly elevated levels of naturally occurring radionuclides, i.e., isotopes that produce ionizing radiation. Most notable is the isotope ^{238}U. Natural background in soils varies significantly throughout the United States but generally ranges from 2 to 10 picocuries per gram (pCi/g), whereas phosphate ore contains 23 to 28 pCi/g of ^{238}U. In addition, the ^{238}U found in ore is in equilibrium with all of its decay daughters, including radium, radon, and polonium (i.e., all of the decay daughters would be expected to range from 23 to 28 picocuries per gram in the ore as well). This level of radiological activity does not pose a threat to persons on a mine site. However, certain common sense precautions are worth noting. These precautions are similar to those used to prevent exposure to other trace elements in media being sampled, i.e., avoid inhalation and ingestion. The precautions include:

- Avoid breathing dusts;
- Do not eat and drink in dusty areas;
- Use proper hygiene techniques such as washing your hands prior to eating;
- Change clothing daily if clothing becomes soiled with ore. Note that clothing can be washed normally to remove the ore; and,
- If using a respirator, ensure that you keep the respirator clean.

2.3 PHYSICAL HAZARDS

Physical hazards associated with active mine sites as well as those associated with persons working out-of-doors in a mountainous terrain probably pose the greatest threat to field personnel on this project. The physical hazards that may be encountered will vary according to the type of site being investigated. Active mines pose hazards that are specific to mine operations, including the operation of heavy equipment, blasting, and the possibility of mine wall collapse. Large mine haul trucks may travel at relatively high rates of speed and pose a unique traffic threat to anyone traveling on mine haul roads. Railroad trains are also used at mines to haul ore to processing plants and pose railroad crossing hazards. Field personnel working on or around mine traffic areas should be especially mindful of mine-related traffic and mine-specific traffic rules.

Mine wall collapse could also occur at inactive mine sites. At some of the older mines, driving or walking near a high wall may pose a significant hazard as well. Field personnel are required to wear hardhats and safety glasses whenever they are in a mine pit, near a high wall, or any other situation in which an overhead hazard may exist. Field personnel must be alert and aware of their surroundings. Therefore, prior to entering an inactive mine site, MWH personnel must be cautious and aware of any potential instability that could lead to rock slides, the collapse of high walls, and other physical hazards. MWH personnel will also be acquainted with the signs of instability that could lead to rock slides, the collapse of high walls, and similar hazards.

At other sites, hazards associated with collecting samples are likely to be minimal. Traveling by foot through, or collecting samples in, pasture land, cropland, or forest, possible hazards may be largely limited to slipping, tripping, and falling. It is important that proper footwear is always worn, and that care and common sense is always used while walking to and from stations. Safety glasses are also required while collecting soil and vegetation samples due to the possibility of dust or other debris blowing into the eye. While hiking to and from a sample location, it is also a good idea to wear eye protection to protect from tree branches and other eye-level hazards. Stream sampling can pose risks associated with loss of balance, including head and limb injuries, scrapes, hypothermia, and drowning. Personnel will need to use good judgment to determine whether it is safe to enter a body of water. In particular, while sampling from streams or rivers, field personnel should be aware of hazards that may be created by high or turbulent water, including being swept out by the current. Additionally, field personnel should be aware of hazards that may be created by stepping in deep, soft sediments, or floating debris.

Travel to remote areas engenders additional hazards specific to the method of travel. Hazards associated with foot travel include muscle strains and sprains, dehydration, heat or cold stress, and slips, trips, and falls. If a sample location cannot be reached by vehicle, and a significant hike is required, precautions must to be taken to ensure that field personnel are properly protected from the weather, whether it is heat stress or cold stress. Hazards associated with vehicle transport include flat tires, getting the vehicle stuck, and other miscellaneous vehicle malfunctions. It is essential that both the vehicle operator and vehicle passengers are cautious and observant of on/off road obstacles and dangers. Operator and passengers should also carry a 2-way radio and cell phone or satellite phone (if available) with them at all times, and know how to change a flat tire on the vehicle.

Travel in remote areas can also pose hazards that are best countered by acquiring a knowledge of wilderness safety, awareness of methods for handling contact with animals, and by safely operating equipment. Specific hazards associated with travel in remote areas are listed in Appendix A, *Activity Hazard Analysis*, together with recommended practices and procedures to minimize risks to MWH and subcontractor field personnel. Table 2-2, *Ten Essentials for Wilderness Travel* lists the ten essential items that field personnel should always have with them when working in remote areas.

Overseeing well installation presents a unique set of physical hazards due mainly to the heavy machinery used. Hearing protection is essential as well as hard hats and safety glasses to protect from flying debris caused by drilling. Long hours in one location on hot, sunny days present a challenge in staying cool while donning required PPE. Sunscreen, light colored clothing, and replenishing fluids are essential. Taking refuge inside of a vehicle may be acceptable if the drilling supervision task is not compromised. Furthermore, hands should be kept away from all moving parts and care should be taken when walking around drilling sites to avoid slips, trips, and falls.

TABLE 2-1
OCCUPATIONAL EXPOSURE LIMITS AND TOXICOLOGICAL PROPERTIES FOR POTENTIAL CHEMICAL EXPOSURE HAZARDS

Contaminant	OSHA PEL (mg/m^3)	NIOSH REL (mg/m^3)	ACGIH TLV (mg/m^3)	ACGIH/OSHA STEL	OSHA/NIOSH IDLH (mg/m^3)	IP (eV)	Route of Exposure	Symptoms of Exposure
Cadmium	0.005 (see 29 CFR 1910.1027)	Ca (lowest feasible)	0.01 & 0.002 (respirable fraction)	NA	50	NA	INH, ING	Pulmonary edema, dyspnea, cough, chest tightness, pain, headache; chills, muscle aches; nausea, vomiting, diarrhea; emphysema, mild anemia
Fluoride, as F	2.5	2.5	2.5	NA	500	NA	INH, ING, CON	Eye irritation, respiratory system, nausea, abdominal pain, diarrhea, excessive saliva, thirst, and sweat.
Molybdenum (soluble compounds as Mo)	5	NA	0.5 (respirable fraction)	NA	NE	NA	INH, ING	In animals: irritant to eyes, nose and throat; anorexia; diarrhea; weight loss; listlessness; liver and kidney damage.
Nickel (soluble compounds as Ni)	1	0.015 (Ca)	0.1	NA	10 (Ca)	NA	INH, ING, CON	Headache, vertigo; nausea, vomiting, epigastric pain, substernal pain; cough, hyperpnea; cyanosis; weakness; leukocytosis, pneuitis; delirium, convulsion.
Selenium	0.2	0.2	0.2	NA	NA	NA	INH, ING, CON, ABS	Irritant to eye, nose and throat; visual disturbance; headache; chills, fever; dyspnea, bronchitis; metallic taste, garlic breath, gastro-intestinal disturbance; dermatitis; and skin, eye burns.
Vanadium (as Vanadium pentoxide)	0.5	0.05	0.05	0.5 (ceiling value)	1	NA	INH, ING, CON	Irritant to eyes; green tongue, metallic taste, eczema; cough; fine rales, wheezing, bronchitis, dyspnea; irritant to the throat
Zinc	NA	NA	NA	NA	NA	NA	INH	Sweet, metallic taste; dry throat, cough; chills, fever; tight chest, dyspnea, rales, reduced pulmonary function; headache, blurred vision; muscle cramps, low back pain; nausea, vomiting; fatigue, lassitude and malaise

ACGIH-American Conference of Governmental Industrial Hygienists
Ca-NIOSH considered carcinogen
CFR-Code of Federal Regulations
CON-Skin or mucous membrane contact
eV-Electron volts
IDLH-Immediately dangerous to life or health
ING-Ingestion
INH-Inhalation
IP-Ionization potential

NA-Not applicable or available
NE-Not established
NIOSH-National Institute of Occupational Safety and Health
OSHA-Occupational Safety and Health Administration
PEL-Permissible exposure limit
REL-Recommended exposure limit
STEL-Short term exposure limit
TLV-Threshold limit values

Table 2-2 Ten Essentials for Wilderness Travel		
To Find Your Way	**For Your Protection**	**For Emergencies**
Map of the area Compass and/or GPS(with sufficient backup battery) Flashlight or headlamp	Sunglasses Extra food and water Extra clothing	Waterproof matches Candle, fuel tablets, or other long–burning fire starter Pocket knife First aid kit

Low-flow well sampling also presents unique physical hazards. Compressed nitrogen gas is often used to provide air pressure and the large storage cylinders can be difficult to manage. Cylinders are to be stored in a secured upright position at all times, in temperatures not exceeding 52º C (125 º F), and valves should be closed whenever not in use (even if empty). Cylinders should not be dropped, rolled, or dragged, and should be transported using a suitable hand truck. Additional information can be found in Appendix J in the Nitrogen MSDS.

Portable gasoline powered generators may also be used to power air compressors to provide air pressure during low-flow well sampling. Portable generators should only be used in wide open spaces; carbon monoxide poisoning from the toxic engine exhaust is deadly. Gasoline for the generator must only be stored in flammable liquid safety cabinets and should only be used to refuel the generator after it has been turned off and allowed to cool. Gasoline spilled on hot engine parts could ignite. Additional safety information can be found in Appendix K.

2.4 BIOLOGICAL HAZARDS

Biological hazards that could potentially be encountered at during the Inactive Mines Site Investigation may include snakes, spiders, ticks, fleas, big game and other wildlife, aggressive livestock, poisonous/irritating plants such as poison oak and poison ivy, and micro–organisms such as the hantavirus.

Field personnel should be aware of their surroundings and avoid contact with snakes and insects. Snakes, spiders, and fleas typically occupy cool, dark, moist areas. The possibility of an encounter most frequently arises when reaching into dark, covered places. Suggestions for controlling the risks associated with snakes and insects include using a long stick to break apart webs or to remove soil cover from sheltered areas. A flashlight should also be used to inspect dark cavities before reaching into them.

Big game animals (deer, elk, and moose) are often seen from vehicles while traveling to and from sites, but are easily scared away and are rarely seen on foot. If big game is encountered while on foot, the National Parks Service (NPS) recommends staying at least 75 ft (25 yds) away. While generally docile, if game feel threatened, they will charge and attack; especially females with young. Other more dangerous wildlife (but notably more uncommon) may include wolves, bear, mountain lions, and coyotes. The NPS recommends staying at least 300 ft (100 yds) away if one of these is encountered.

Aggressive livestock are another (rare but legitimate) biological safety concern. It may be necessary to enter an active pasture to access a sample location. Livestock are generally very skittish and can easily be frightened, but personnel should still be cautious, maintain a distance of 75ft (25 yds), and avoid turning their back on the animals. A pasture or enclosure with a male cow (bull) should never be entered. Adult males are generally separated from the females and juveniles and are kept by themselves. They are easily distinguished and are very volatile; they should not be approached.

As a matter of courtesy, field personnel should obtain permission from private landowners prior to entering private lands and immediately close any gates opened in order to access sampling stations and when leaving such stations to make sure that livestock do not inadvertently escape.

Poisonous plants such as poison ivy and poison oak grow wild in dark, moist areas, and at the base of or around seedling and adult trees. Some individuals are prone to skin rashes on contact with the oil from certain plants. A visual site inspection and identification of possible poisonous plants should be completed prior to each shift so that assigned personnel are aware of the potential for exposures.

The Center for Disease Control in Atlanta, Georgia has established a hotline for inquiries regarding the hantavirus, at (877)-232-3322. Hantavirus has resulted in several deaths in the western part of the United States. While there may not have been any outbreaks or notices of the virus at a given project site, field personnel should be aware of the exposure route for the hantavirus and potential control methods. The hantavirus is transmitted through atmospheric dispersion of dried rodent excreta. The disease associated with the hantavirus begins with one or more symptoms that may include fever, muscle aches, headache, and cough. The disease progresses rapidly to a severe lung disease that often requires intensive care and treatment.

3.0 ASSIGNMENT OF RESPONSIBILITIES

Implementation of the Health and Safety Plan will be accomplished through an integrated effort of the following personnel:

Table 3-1: Project Health and Safety Program Contact List

Company or Agency	Contact	Title	Telephone
P4 Production	Barry Koch	Special Project Lead—Mining / Program Manager	208-547-1439
	Paul Stenhouse	Environmental Regulatory Specialist	208-547-1294
MWH	Howard Lee	Vice President-in-Charge	425-602-4000
	Cary Foulk	Project Manager	970-879-6260
	Bill Wright	Senior Advisor	425-602-4000 / cell: (b) (6)
	Jack Storace	Regional EH&S Manager	925-627-4734 cell: (b) (6)
	Colin Duffy	Program Safety Officer (PSO) On-site Safety Officer (OSO) Field Team Leader (FTL) or Assistant FTL	425-602-4000
	Dean Brame	FTL or Assistant FTL and Quality Manager	425-602-4000

Figure 3-1 presents the complete program organizational structure including responsibilities under the project health and safety program. The roles of the key individuals from the preceding table are discussed further in the following paragraphs.

3.1 VICE PRESIDENT-IN-CHARGE

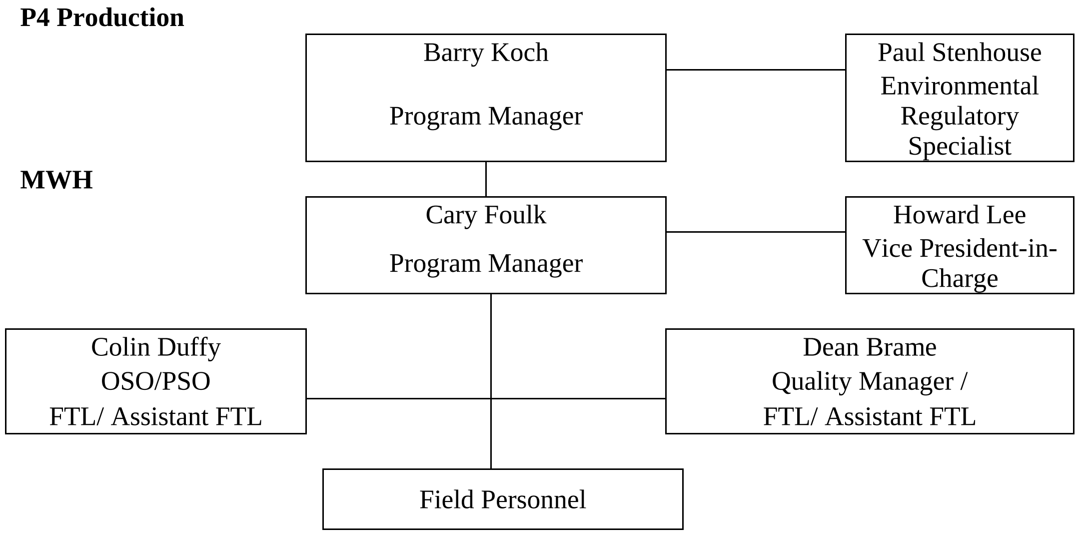
As the senior management representative for the program, the Vice President-in-Charge is responsible for defining program objectives, allocating resources, establishing the management organization, and evaluating program outcomes. The Vice President-in-Charge, working through the assigned MWH Program Manager, is ultimately responsible for:

- Providing the facilities, equipment, and budget needed to perform work safely;
- Ensuring adequate personnel and schedule for safe operations;
- Ascertaining appropriate review and distribution of health and safety documents;
- Supporting the efforts of program and field personnel; and,
- Applying appropriate disciplinary action for unsafe acts or practices.

3.2 PROJECT MANAGER

The Project Manager has overall responsibility for the safe performance of project activities. If a health and safety issue develops in the course of performing the contract that requires consultation with the client, the Project Manager is responsible for contacting the appropriate client representative and obtaining agreement on necessary actions, and for providing project personnel with suitable guidance.

Figure 3-1
Health and Safety Program Organization Chart



3.3 PROGRAM SAFETY OFFICER

The PSO shall:

- Work with the OSO to implement the requirements of this Health and Safety Plan.
- Be available for consultation with the Project Manager, FTL, and the OSO during the course of field work covered by this Health and Safety Plan.
- If needed, conduct periodic inspections of field activities to evaluate the effectiveness of the health and safety program and compliance with the Health and Safety Plan.
- Be responsible for the preparation of and any subsequent amendment to the Health and Safety Plan.
- Consult with the Project Manager as necessary prior to approving changes to the Health and Safety Plan.
- Coordinate modifications to the Health and Safety Plan with the OSO.
- Prepare the materials to be used for project-specific health and safety training.

The PSO is also responsible for the following:

- Ensuring that health and safety documentation conforms to applicable federal, state, and local health and safety requirements.

- Ensuring that medical monitoring, incident reporting, and health and safety recordkeeping conform to applicable federal, state, and local requirements.

- Overseeing project-specific employee training and medical surveillance.

3.4 ON-SITE SAFETY OFFICER

The MWH OSO has the responsibility and authority to halt or modify any activity or to remove personnel from the site if he or she considers conditions to be unsafe. Additionally, the OSO shall:

- Be responsible for implementing the requirements of this Health and Safety Plan.

- Maintain current certification in cardiopulmonary resuscitation (CPR) and first aid.

- Ensure that field personnel understand and comply with safety requirements, as outlined in this Health and Safety Plan.

- Ensure that a copy of the Health and Safety Plan accompanies each sampling team.

- Coordinate with the PSO, FTL, and Project Manager to address any unanticipated conditions that develop during the course of field activities.

- Coordinate with any subcontractor-designated OSO to resolve unsafe behavior and unsafe conditions posed by subcontractor personnel.

- Be responsible for dismissing subcontractor personnel when resolution of unsafe acts and conditions cannot be reached.

- Obtain approval of amendments to the Health and Safety Plan from the PSO before implementing any deviations from stipulated health and safety procedures.

- Provide the field personnel with the JRA worksheets and review them daily during tailgate safety meetings.

- Conduct and document daily safety debriefing meetings and inform team leader of any accidents or near hit/misses.

- Be responsible for controlling the entries to and exits from sampling locations.

- Monitor on-site hazards and conditions.

- Monitor field personnel for signs of thermal stress and fatigue.

- Enforce the buddy system.

- Enforce procedures for personnel and equipment decontamination, as specified in this Health and Safety Plan.

- Know emergency procedures and evacuation routes, as well as the telephone numbers of the nearest ambulance service, local hospital, poison control center, fire department, and police department.

- Verify the route to emergency medical facilities, and ensure that route information is posted.

- Serve as the primary MWH contact during any on-site emergency.

- Direct responses to emergencies as outlined by emergency response plans (see Appendix B).

- Participate in accident/incident and near miss investigations.

- Ensure that personal protective equipment (PPE) specified for use in this Health and Safety Plan is available and is being used by project personnel.

- Ensure that equipment used for assessing health hazards is calibrated and maintained in good working order.

- Periodically inspect protective clothing, as well as equipment used for assessing health hazards, for defects and signs of wear.

- Inspect and maintain first-aid kits and other emergency supplies.

- Confirm with the PSO or the responsible subcontractor official the ability of each individual assigned to field activities to perform site work, and maintain a file of current training and medical surveillance certificates.

- Enforce written medical restrictions for field personnel, as necessary.

3.5 FIELD TEAM LEADER

The FTL is responsible for assembling and managing the field personnel and field equipment during the sampling event. He should thereby assist the OSO in looking out for unsafe equipment and procedures. The FTL is also responsible for managing the sampling schedule and determining what team members sample what location or perform what task. There may be an occasional task or sampling location is more difficult to undertake, or reach, than others. It is therefore be the responsibility of the FTL to delegate tasks responsibly, keeping safety in mind. The FTL is responsible for sending, via email, a daily field report to the P4 Production Program

Manager. Thus it is the responsibility of the FTL to discuss with the OSO any incidents so that the FTL can include this in his/her daily report.

3.6 FIELD PERSONNEL

Field personnel are also responsible for understanding and complying with the requirements of this Health and Safety Plan, and are required to sign an acknowledgment to that effect. Field personnel are also responsible for bringing perceived unsafe conditions, accidents, or near hits/misses to the attention of the FTL and OSO during each daily safety debriefing meeting, or sooner if conditions warrant. During the daily tailgate safety meetings, any subcontractor personnel who will be providing services shall inform the rest of the field team of any additional hazards posed by their procedures or the operation of their equipment.

3.7 SITE VISITORS

Visitors, including MWH and subcontractor management or staff, regulatory agency personnel, or client personnel, may be present at the project site during field activities. Visitors can most likely be provided with a general viewing area at a safe location that will not contribute any cross contamination. The OSO can provide a brief overview of the field activities to any site visitors.

If unannounced visitors request access to a project site, the OSO shall inform the appropriate client representative to obtain permission or denial of access.

4.0 PERSONNEL TRAINING

Individuals assigned by MWH to complete field work in the Southeast Idaho Phosphate Resource Area will, as appropriate, be required to meet the general site worker standards of this Plan including the training requirements described below.

4.1 INITIAL SITE-SPECIFIC HEALTH AND SAFETY TRAINING

Site-specific health and safety training will be provided by P4 to MWH employees charged with completing the field assignments as part of this investigation. This site-specific safety training attempts to encompass all hazards that may be encountered at any of the P4 mines. This training also contains a vehicle safety checklist that must be passed before driving on the premises is allowed. This training document is attached herein as Appendix G, *Monsanto Contractor/Guest ES&H Site Guidelines*. P4 also requires contractors to complete a pre-Job Risk Analysis (JRA) worksheet for each individual job the contractor performs. JRAs are meant to bring to light the potential hazards and risks associated with each job. A blank JRA worksheet is attached herein as Appendix E. Furthermore, N.A. Degerstrom Inc., the contracted on-site mining operator, requires that all users of the haul roads at the site be trained in haul road safety. A copy of the Degerstrom training document is attached herein as Appendix H, *Degerstrom Ore Haul Road Travel Requirements*.

P_4 Production's three mine sites, associated surface water features that drain these mine sites, and applicable background locations, form the study area for the project for which this health and safety plan covers. A specific map of the project area is located in the Field Sampling Plan.

On the basis of available and extensive information, MWH has demonstrated that the work being conducted under this plan does not involve the reasonable possibility for employee exposure to safety or health hazards attributable to hazardous substances. Furthermore, the waste rock, which is the source of contamination of interest, does not meet the four-prong definition of a hazardous substance per 29 CFR 1910.120(a)(3). Therefore, the training requirements of 40 CFR §1910.120 are not applicable to field personnel involved in the 2009 sampling efforts.

It is the responsibility of the OSO to review each area subject to sampling, prior to allowing a field team to enter the area, to ensure that none of the proposed sampling areas fall within the above-listed locations or activities. If a proposed sampling location or activity is determined by the OSO (or other informed person) to fall within one of the above-listed locations or activities, the OSO has the authority and responsibility to stop the proposed sampling activity until it is ascertained that the field personnel entering the area meet the requirements of 40 CFR §1910.120, including the appropriate level of HAZWOPER training.

Notwithstanding the above statements, MWH expects that all field personnel are familiar with, understand, and follow the health and safety requirements and guidance provided in this manual. Training will be conducted prior to job start-up, and as needed thereafter. The PSO, OSO, and/or the Program Manager(s) will conduct the initial site-specific training to ensure that field personnel have a thorough understanding of this Health and Safety Plan, applicable standard operating procedures (SOPs), and the chemical, physical, and biological hazards that may be associated with the investigation. This training will be repeated for new field personnel tasked with field assignments connected with the investigation as well, prior to starting field work.

Topics that will be addressed in the initial site-specific health and safety training will include the following:

- Names of personnel and others responsible for project safety and health.
- Employee rights and responsibilities under OSHA.
- The Health and Safety Plan, including the medical surveillance program.
- The acute and chronic effects of exposure to hazardous substances that may be encountered during field activities; the potential routes of exposure and symptoms of exposure for these substances; the PELs and IDLH concentrations assigned to these substances; and the level of personal exposure that can be anticipated.
- Likely physical hazards such as slipping, tripping, or falling; noise; electrocution; being struck; or being caught in or between moving equipment.
- Site control measures, including procedures for chemical handling, spill containment, decontamination, fire prevention, and any SOPs prepared specifically for the project.
- Hazard communication (per the requirements of 40 CFR § 1910.1200).
- PPE and the action levels for upgrading PPE and for evacuating work sites.
- Engineered controls such as dust suppression techniques adopted for this project.
- Emergency procedures and equipment.
- Any procedures adopted for air monitoring, including the functions, limitations, use, and maintenance of monitoring equipment.
- Proper use of heavy equipment and machinery, as applicable.
- Personal cleanliness and restrictions on eating, drinking, and smoking at the job site.
- Heat and cold stress prevention, monitoring, and treatment.
- Contractor injury and illness prevention programs, if applicable.

Field Personnel will also be instructed in the use of the buddy system. The buddy system will be used whenever field personnel are collecting samples from any location in the project study area. The buddy system is a method of organizing work groups so that an individual is always available to provide his or her partner with assistance in an emergency; to monitor his or her partner for signs of chemical or physical exposure, to periodically check that his or her partner's PPE is functioning properly, and to notify emergency response personnel if an emergency occurs. The buddy system usually requires that two or more people maintain visual contact while working. However, the buddy system can employ radio or cell phone contact if site conditions are such that a person could otherwise work alone. In order to deviate from the buddy system, the PSO will require an explanation of the specific task to be completed, along with a procedure for assuring that a single person work party is safe.

Note that activities that will be conducted during the investigation do not require the MSHA 24-hour training specified under 30 CFR 48.21 through 48.30, though it is recommended. The OSO will maintain documentation that each site worker has successfully completed the initial site-specific training and any additional safety training furnished by a mine operator at an active mine site.

4.2 TAILGATE SAFETY MEETINGS

Tailgate safety meetings will be conducted by the OSO each day field activities take place. This meeting will review the JRAs for the applicable jobs, cover site activities, changes in site conditions, other activity-specific health and safety issues, and include a review of pertinent topics detailed in the initial site-specific health and safety training. Field personnel will also be informed of the availability of emergency assistance, as well as the most probable route of evacuation from a site, should an evacuation become necessary.

A daily safety debriefing will also be conducted at the conclusion of every work day; at which any unsafe working conditions or equipment and any incidents or near hits/misses must be discussed and documented. The OSO must inform the FTL of any such incidents.

If MWH personnel are working directly with a contractor (i.e. a well driller), the MWH contractor supervisor is to engage in this same tailgate safety meeting process and report to the OSO or PSO any safety concerns and incidents or near hits/misses.

4.3 BLOODBORNE PATHOGENS AND FIRST AID/CPR

Personnel assigned to conduct field work for this project do not conduct first aid or CPR as a primary job function. Rather, selected field personnel (e.g., the OSO) have been trained in first aid and CPR for application in an emergency only. Acting in the capacity of a designated emergency first aid provider is not mandatory, and anyone who is uncomfortable with the possibility of being so designated should notify the OSO.

4.4 DOCUMENTATION OF TRAINING

Written documentation verifying compliance with the training requirements of this section must be submitted to the MWH PSO or OSO prior to the beginning of field work or site access. Documentation of each worker’s current training credentials will be kept by the OSO for review by authorized agency personnel.

5.0 MEDICAL SURVEILLANCE

Personnel who will be completing field assignments in support of the investigation on locations or involved in activities in which the requirements of 29 CFR § 1910.120 govern (see discussion in Section 4.1 of this Plan), must be participating in a medical surveillance program consistent with the requirements of that regulation. These requirements mandate that field personnel receive medical examinations prior to participating in hazardous waste site activities; annually; upon termination; following occupational exposure or injury; and additionally as needed, on a case-by-case basis.

The medical surveillance program required of each company that allows personnel to conduct field work at hazardous waste sites must be overseen by a licensed physician who is certified in occupational medicine by the American Board of Preventive Medicine, or, who by training and experience, is Board-eligible. When applicable, the MWH PSO will maintain copies of the physician’s written authorization statements that employees conducting hazardous waste site operations are fit for hazardous waste site duty and are able to wear respiratory protection. No one shall be permitted to participate in hazardous waste site operations subject to these requirements until a copy of their medical certification is received by the MWH PSO. Copies of the physician’s authorization for field personnel will be available to the field personnel upon request. Medical and exposure records will be retained for the length of the employee’s employment, plus 30 years.

Field personnel will receive additional medical monitoring upon notifying the OSO, PSO, Program Manager, or other authorized MWH personnel of symptoms consistent with over-exposure to site contaminants, or if the employee is injured or exposed to contaminants at concentrations in excess of a PEL during emergency response operations. Further medical examinations may be required before an employee returns to work after a serious illness or injury. Such examinations may be necessary to assure the employee’s continued ability to carry out assigned duties. The need for these examinations will be determined by the MWH PSO, in cooperation with the occupational health physician representing the company. An injury or illness incurred by one of the field personnel, whether on or off the job, shall be reported to the PSO or OSO immediately. Such injury or illness may also require work restrictions when/after the employee returns to work. If the injury or illness required seeing a physician, either the attending physician or the physician giving the employment physical will be involved in deciding when the employee can return to work, and if any work restrictions will apply.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 PERSONAL PROTECTIVE EQUIPMENT

The Environmental Protection Agency (EPA) designations of Levels D, C, B and A for PPE are used to describe the general PPE ensembles that may be employed during hazardous waste site operations. These ensembles are depicted in Figure 6-1. Based on site contaminant information and established exposure limits, Level D has been selected as the level of protection appropriate for field personnel during this investigation. Field personnel will also adhere to the requirements of individual mine operators when collecting samples at active and inactive mine sites. These requirements may include the use of hardhats, eye protection and steel-toed boots. It is the responsibility of the OSO and the OSO representing any subcontract personnel to ascertain the appropriate/required level of PPE for each mine site, communicate such findings to the field personnel, and to ensure that the field personnel are provided with the PPE in a timely manner.

PPE that will be employed for project field tasks and procedures is identified in the Activity Hazard Analysis in Appendix A. For activities undertaken during this project, personnel will incorporate the following into the standard Level D ensemble:

Coveralls:	Personnel will wear a work uniform that includes long pants and a short-sleeved t-shirt at a minimum.
Gloves:	Nitrile gloves are required when handling samples, reagents, decon solutions, and calibration standards.
Hardhat:	Personnel will wear a hardhat when entering active and inactive mine pits to protect against rock falls, when they are visible from the haul road, and when supervising well installations.
Safety Glasses:	Personnel will wear safety glasses when entering active and inactive mine pits and when visible from the haul road. They will also be worn during sample collection, equipment decontamination, and when supervising well installations.
Ear Plugs:	Personnel will use ear plugs or ear muffs with sufficient muffling abilities while drill rigs are in operation.

Once on site, the OSO and the OSO representing any subcontractor personnel will evaluate work conditions and adjust the level of PPE as necessary to properly protect field personnel and meet the local mine requirements. When specifying a PPE ensemble, the following will be evaluated:

- The local mine requirements;
- The anticipated site hazards that were used to select the initial PPE ensemble;
- The limitations of each piece of PPE;
- Work duration;
- The effect of temperature extremes on the PPE ensemble;

- PPE maintenance, storage, decontamination, and disposal requirements;
- Inspections of PPE completed prior to, during, and after use;
- Personnel training in PPE use and the need for fit-testing;
- Procedures for donning and doffing; and
- Evaluation of the effectiveness of the current PPE program.

Adjustments to the PPE ensemble will be communicated to field personnel via amendment of this Health and Safety Plan or during the tailgate safety meeting.

6.2 LEVEL D PERSONAL PROTECTIVE EQUIPMENT

Level D protection may be used when the following conditions are met:

- Substances that pose inhalation hazards are not present above individual or combined PELs.

- Oxygen is present at a minimum concentration of 19.5 percent.

- Toxic organic compounds are not present in the air space at concentrations that exceed normal background concentrations or specified action levels requiring use of respiratory protection.

- Work functions preclude splashes, immersion in, unexpected inhalation of, or direct contact with hazardous concentrations of harmful chemicals.

Level D protective equipment shall consist, at minimum, of the following:

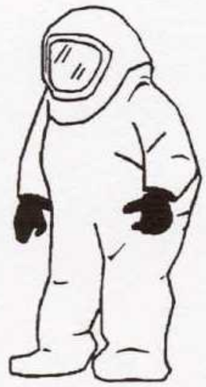
- Dedicated work uniforms with long pants and short-sleeve shirt.

- Steel-toed and shank leather, PVC, or rubber safety shoes or boots meeting the specifications of American National Standards Institute (ANSI) Z41.

- Safety glasses, goggles, face shield, or other approved eye protection.

- Hardhat, unless specifically stated otherwise.

The dedicated work uniforms may include chemical-resistant coveralls or standard Tyvek coveralls, or standard cotton or cotton blend work uniforms. Approved eye protection must meet the specifications of ANSI Z87.1. The use of contact lenses is discouraged, but not prohibited, during Level D operations. However, safety glasses or goggles that fit over prescription lenses or prescription safety glasses or goggles are recommended. Approved hardhats must meet the specifications of ANSI Z89.1.



Level A Protection
Totally encapsulating vapor-tight suit with full-facepiece SCBA or supplied-air respirator.

Level B Protection
Totally encapsulating suit does not have to be vapor tight. Same level of respiratory protection.

Level C Protection
Full-face canister air purifying respirator. Chemical protective suit with full body coverage.

Level D Protection
Basic work uniform, i.e. longsleeve coveralls, gloves, hardhat, boot, faceshield or goggles.

SAMPLE PROTECTIVE EQUIPMENT ENSEMBLES
FIGURE 6-1

6.3 PPE STORAGE

PPE must be stored properly to prevent damage or malfunction due to exposure to dust, moisture, sunlight, damaging chemicals, extreme temperatures, and impact. Potentially contaminated PPE should be stored separately from new PPE and street clothing. Field personnel should always review the manufacturer's instructions for care and maintenance of PPE. PPE storage will be provided in the field by the OSO. However, each individual is responsible for ensuring that his or her issued PPE is protected from extremes of temperature, and is stored in a manner that prevents the PPE from becoming damaged or disfigured.

7.0 HAZARD ASSESSMENT

Because of the relatively low exposures that are expected during the investigation, no vapor or dust monitoring will be undertaken. However, personnel monitoring for heat and cold stress will be performed. Heat and cold stress will be monitored qualitatively, as described in the following paragraphs.

7.1 HEAT STRESS

The stress of working in a hot environment can cause a variety of illnesses, including heat exhaustion or heat stroke; the latter can be fatal. The use of PPE can increase heat stress significantly, although heat stress can overcome people wearing regular, permeable work clothing, as well. To reduce or prevent heat stress, frequent rest periods and the intake of salts and liquids to conserve and replace body fluids may be necessary.

Personnel should recognize the symptoms of heat stress, and take appropriate action on recognition. Some of the symptoms that indicate heat exhaustion are:

- Clammy skin
- Lightheadedness
- Slurred speech
- Rapid pulse
- Weakness, fatigue
- Confusion
- Fainting
- Nausea (vomiting)

If these symptoms are noted, the following steps should be taken:

- Remove the victim to a cool and uncontaminated area;
- Remove protective clothing; and
- Give water to drink, if conscious.

Symptoms that indicate heat stroke include:

- Staggering gait
- Hot skin, temperature rise (yet may feel chilled)
- Incoherent, delirious
- Mental confusion
- Convulsions
- Unconsciousness

If these symptoms are noted, the following steps should be taken:

- Remove victim to a cool, uncontaminated area;
- Cool the victim, whole body, with water, compresses and/or rapid fanning;
- Give water to drink, if conscious; and
- Transport the victim to the designated medical facility for further cooling and monitoring of body functions.

HEAT STROKE IS A MEDICAL EMERGENCY!

7.2 COLD STRESS

On days of low temperature, high wind, and humidity, anyone can suffer from the cold. Severe exposure to cold can be life threatening. Several factors increase the harmful effects of cold: being very young or very old, wearing wet clothing, having wounds or fractures, smoking, drinking alcoholic beverages, fatigue, emotional stress, and certain diseases and medications.

Cold weather injuries may be local or systemic. Local cold weather injuries include chilblains (chronic injury of the skin and peripheral capillary circulation) and frostbite. Frostbite occurs in three progressive stages: frostnip, superficial frostbite, and deep frostbite. Systemic cold injuries associated with hypothermia affect the entire body system. Hypothermia is caused by exposure to cold and is aggravated by moisture, cold winds, fatigue, hunger, and inadequate clothing or shelter.

Precautionary measures that will be taken to prevent or mitigate cold stress will include:

- Providing field shelters or wind screens.
- Monitoring temperature and wind speed to determine appropriate safety measures.
- Adjusting work schedule based on weather conditions and temperature.
- Providing insulated clothing for field workers.
- Adhering strictly to the buddy system so that workers can monitor for symptoms of cold stress in their co-workers.

7.2.1 Frostbite Monitoring

Frostbite is a potentially crippling condition that can occur when inadequately protected skin or body parts are exposed to freezing weather. Team members should continually be alert for signs of frostbite in co-workers, and bring any occurrences to the attention of the OSO. A cold feeling, pain, and numbness precede the onset of frostbite. Frostbite usually appears as gray or white waxy spots on skin. Areas most susceptible to frostbite are the nose, ears, and cheeks.

The following steps should be taken to avoid frostbite:

- Dress warmly;
- Wear layers of clothes;
- Keep boots and gloves loose-fitting;
- Stay dry;
- Carry extra clothing;
- Avoid touching cold metal with bare hands; and
- Avoid spilling cold fuel, alcohol, or other liquids that freeze below 32°F on your body or clothing.

If a person is frostbitten, get them to a hospital as soon as possible. If transport to a hospital is not immediately available, get the person to a warm shelter and immediately perform the following:

- Cover exposed areas with additional clothing;
- Wrap the person in blankets or a sleeping bag;
- Give the person warm, non-alcoholic drinks;
- Undress the frozen part and submerge the frozen part in a tub of warm water (102° F to 105°F), or put the frostbitten person in a large tub of warm water, if available, and stir the water;
- Warm with skin to skin contact, such as placing warm hands on frozen nose or ears, (but do not rub); and
- Get the person to a hospital as soon as possible.

Do not rub the frozen part; do not give the person liquor; do not allow the person to walk on thawed feet; do not let the person smoke; do not break any blisters that may form; do not let the thawed part freeze again; and do not warm the frozen part in front of a source of dry heat, such as an open fire or oven.

7.2.2 Hypothermia Monitoring

Hypothermia is a lowering of the body's temperature due to exposure to cool or cold temperatures. Field personnel should be continually alert for signs of hypothermia in co-workers, and bring any signs of hypothermia to the attention of the OSO. Most cases of hypothermia occur at temperatures between 30°F and 50°F. Hypothermia is a medical emergency: if not properly treated, hypothermia can cause death. Safety equipment for hypothermia should include a synthetic sleeping bag and a hypothermia thermometer. Personnel suffering from hypothermia should be transported to a hospital as soon as possible, even if they appear to be recovering.

To prevent hypothermia:

- Eat well prior to exposure;
- Dress warmly; and
- Avoid becoming wet through sweating, rain or snow, or falling in water.

Early signs of hypothermia may include violent shivering, slurred speech, a loss of coordination, confusion and an inability to answer simple questions, unusually irritable or strange behavior, or a tendency to drop or lose clothing or equipment. As hypothermia progresses into more serious stages, the victim typically develops trouble seeing clearly, becomes sleepy and numb, and begins to move with difficulty. Eventually, the victim will lapse into unconsciousness if not properly cared for.

The following actions should be taken to treat a hypothermia victim:

- Get the victim to a warm, dry shelter as soon as possible;
- Remove any wet or cold garments and dry the person thoroughly; and

- Wrap the victim in blankets, sleeping bags, or dry clothing to prevent more heat loss.

If a warm area is not available, build a shelter and put the victim in the warmest, driest area available. Remove any wet or cold garments, and have one or more persons remove their clothing and lay next to the victim, providing skin to skin contact. Then, wrap the victim and rescuers in dry, warm blankets, sleeping bags, or clothing. When the victim becomes conscious, place warm objects along the victim's sides to warm vital areas. When the victim is able to swallow easily, provide warm, sweetened drinks and food, preferably candy or sweets. Do not give the victim alcohol or allow the victim to smoke, do not rub the victim's skin, and keep checking the victim and providing additional assistance as needed.

8.0 SITE CONTROL

Site control is an important part of a field health and safety program. The purposes of site control are to minimize potential worker exposures, protect the public from site hazards, and prevent vandalism of site facilities. Site control procedures that will be implemented during the Inactive Mines Site Investigation, which are discussed in this section, consist of site security controls and communication systems.

Under no conditions are deviations from safe work practices to be tolerated by anyone on site. If any deviation continues after a reminder of proper procedures or a reasonable warning, the MWH OSO will be informed of the circumstances. The MWH OSO will attempt to correct the unsafe behavior or unsafe condition. Should this attempt fail, the MWH OSO shall halt site activities and dismiss the non-cooperative personnel.

8.1 MULTIPLE-EMPLOYER JOB SETTING

Enforcing safe work practices at a multiple-employer job site presents many challenges. Under OSHA, each employer is required to provide a safe and healthful working environment for its employees. Most hazardous waste sites require several contractors to work simultaneously on different project tasks. In this situation, the activities of one company could create hazards for the employees of another company. It is not possible to anticipate every hazard associated with activities at a multiple-employer job site in a Health and Safety Plan. The OSO must discuss particular safety and health issues that may be associated with each day's activities at the daily tailgate safety meeting.

8.2 SITE SECURITY

Existing site controls that are likely to be encountered during the course of the investigation will vary from no controls to strict property perimeter controls. When possible, client personnel will be requested to investigate any suspicious activities at the field sites. In some cases, an independent security watch may be needed. Security at the sites will be the responsibility of the client during periods of inactivity, including weekends. To maintain security at the sites during working hours, the OSO will:

- Control site entrances and exits as necessary through the installation of appropriate safety barricades, signs, and/or signal lights.
- Establish a personnel identification system.
- Be responsible for enforcing entry and exit requirements.
- Utilize temporary fencing to control site access, where feasible.
- Post warning signs around the perimeter of the work area, should the use of temporary fencing not be feasible.

To maintain security during nonworking hours, the OSO will secure the site prior to leaving at the end of a working day and equipment and supplies will be secured or stored in locked facilities.

8.3 COMMUNICATION SYSTEMS

Two general types of communication systems should be available for workers assigned to field projects. One system will ensure adequate communication between field personnel, and the other will ensure the ability to contact personnel and emergency assistance off site. Internal communication will be used to:

- Alert team members to emergencies.

- Pass along safety information, such as weather conditions that could affect heat stress, cold stress or general safety.

- Maintain site control.

- Facilitate site work by being able to call the appropriate party for information without having to decontaminate the work party and equipment and secure the site.

Verbal communication can be impeded by background noise and limitations imposed by PPE. It is therefore vital that pre-arranged signals of communication be arranged prior to the initiation of site activities, particularly when heavy equipment may be operating in the vicinity. Common types of internal communication devices include:

- Radios;
- Noisemakers such as compressed air horns, megaphones, sirens, and whistles; or,
- Hand and arm signals.

External communication systems between on-site and off-field personnel are necessary to:

- Coordinate emergency response efforts,
- Report to upper management about site activities, and
- Maintain contact with essential off-field personnel.

The primary means of external communication are telephones, radios, facsimile machines, and computer networks.

9.0 DECONTAMINATION PROCEDURES

Decontamination procedures are implemented to prevent cross-contamination of samples, to control possible migration of site contaminants to clean areas, and to prevent personnel exposure to chemicals or pathogens that may contaminate clothing or protective gear. Personnel conducting field activities must decontaminate upon the completion of these activities. Equipment must also be decontaminated before it is moved. Any material that is generated by decontamination procedures will be labeled and stored until final disposal arrangements are made.

9.1 GENERAL DECONTAMINATION PROCEDURES

Decontamination procedures shall be supervised by the OSO. The type of solution to be used for equipment decontamination is specified in the Field Sampling Plan. Personnel decontamination will be accomplished using ordinary soap and water or an alcohol based hand sanitizer. Personnel will be required to wash or sanitize their hands, and optionally their faces, before eating or drinking, unless specific procedures are in place to ensure that a drink can be taken without the possibility of contamination. Personnel may also be required to wash or sanitize their hands, and optionally their faces, before leaving the work site. Decontamination solutions will be changed daily at a minimum.

The following decontamination procedures and guidelines shall be implemented:

- Disposable protective clothing will be used when possible to eliminate the need for decontaminating clothing.

- Decontamination procedures will be designed to prevent or minimize direct contact with waste materials.

- Disposable protective clothing and contaminated material will be collected in plastic sacks and disposed of appropriately.

9.2 DECONTAMINATION WASTE HANDLING AND DISPOSAL

Wastes generated as a result of site activities will be handled in accordance with applicable environmental regulations. Investigation-derived wastes and contaminated site materials will be handled and disposed of in accordance with the provisions of the Field Sampling Plan or client specifications. Unless specifically stated, personnel are to treat decontamination wastes as part of the investigation derived wastes.

10.0 EMERGENCY RESPONSE PLANNING

The objective of this Health and Safety Plan is to minimize exposure to chemical, biological, and physical hazards, and to prevent work-related illnesses and injuries. Emergency response planning is included as part of this plan to provide procedures for responding to emergencies that may occur. This section contains information on how to deal with emergencies. It is not the purpose of this Health and Safety Plan, however, to provide guidance for emergency response as part of field operations. Field personnel are instructed to assess emergencies and make the appropriate notification to emergency responders. **Under no circumstances are field personnel to take emergency response actions for which they are not properly trained.**

The MWH OSO will serve as the primary MWH contact during any on-site emergency. The OSO will be responsible for making the appropriate notifications, directing responses to emergencies until relieved by a qualified Emergency Medical Technician (EMT) or equivalently trained professional. As part of his or her duties, the OSO will be required to know basic first aid emergency procedures and evacuation routes, as well as the telephone numbers of the nearest ambulance service, local hospital, poison control center, fire department, and police department. The OSO will also be responsible for verifying the route to emergency medical facilities, and ensuring that route information is posted and available to field personnel. Emergency telephone numbers and maps showing the locations of the hospitals and emergency clinics capable of providing emergency service for field personnel are provided in Appendix B. Telephone numbers for the Poison Control Center, local Police and Sheriff's Departments, local Fire Departments, including the emergency rescue squad, the Office of Emergency Services, MWH management, and client contacts also are included. Copies of the hospital route maps provided in Appendix B will be kept in site support vehicles and field personnel will become familiar with the routes and the travel times involved.

The OSO shall immediately notify the Program Manager of the following:

- Any required site evacuation;
- Any fatality or injury to one or more field personnel that requires medical attention; and
- Any physical hazard creating the potential for death or permanent injury.

Vehicles that can be used to transport injured personnel from work sites will be available during working hours. A system will also be available on site for communicating with off-site personnel. On-site communication systems may include cell phones, two-way radios, or other suitable devices. Additionally, first aid supplies and potable water will be available at every site for emergency use.

Cell phones may not always be operable in remote areas. Thus, when entering remote areas field personnel will file their anticipated itinerary with the FTL. The itinerary will include where the field team expects to be, the travel route, and the expected time of return. The field team will notify the FTL upon their return. If the sampling team leaders do not hear from a field team by an agreed-upon time, the FTL will initiate search and rescue operations. In addition, the FTL will attempt to call the P4 Program Manager daily to report on the daily activities, any health and safety issues encountered, and the expected itinerary for the next day.

Prior to the start of work, project personnel will be acquainted with established emergency response procedures and equipment. Furthermore the OSO will be certified to render first aid and CPR prior to commencement of field activities. The buddy system will be used when working in remote areas, near significant waterways, or in active or inactive mine pits. The buddy system will not be required while collecting samples in agricultural areas when cell phone contact is available.

Accidents, safety-related incidents, and safety-related near misses will be documented and reported to the MWH EH&S Department, PSO, OSO and P4 and MWH Program Managers on a daily basis at a minimum.

See Appendix E for incident reporting forms and procedures.

11.0 HEALTH AND SAFETY DOCUMENTATION

Examples of some of the forms that may be employed for documenting compliance with the MWH health and safety program and this Health and Safety Plan are presented in the appendices. The MWH PSO or designated OSO will maintain and update these documents. Appropriate regulatory agency personnel shall be granted access to these records if requested.

Unanticipated field conditions may occasionally require temporary modification of this Health and Safety Plan. Client notification and approval procedures will depend on field conditions and nature of the modification. Any upgrade to PPE will be reported in an updated JRA worksheet. Minor changes to the Health and Safety Plan to accommodate on-site conditions can be implemented by the OSO upon review and approval of the PSO; such changes might include minor revisions to decontamination or site control procedures. Permanent changes to this HSP must be approved by the MWH Regional EH&S Manager as listed in table 3-1.

12.0 GENERAL SITE SAFETY

The health and safety program contained in this portion of each MWH Health and Safety Plan has been developed in accordance with relevant occupational safety and health regulations and requirements, and applies to field sites and workplaces. Because this section is intended to be applicable to a wide range of sites and conditions, there may be information in this section that applies to certain areas of the country only.

The following practices are expressly forbidden during site work:

- Smoking, eating, drinking, chewing tobacco, or applying cosmetics while taking samples or while near exposed samples.
- Contact with potentially contaminated substances; walking through puddles or pools of liquid; kneeling on the ground; or leaning, sitting, or placing equipment on contaminated soil.
- Performance of tasks without a buddy; personnel will be required to use the buddy system unless specifically exempted elsewhere in the Health and Safety Plan.

Personnel must keep the following guidelines in mind when performing field activities:

- Hazard assessment is a continuous process. Personnel must be aware of their surroundings and the chemical and physical hazards that are present.
- Field personnel will be aware of the physical characteristics of each site, including site access, the location of overhead power lines and underground utilities, wind direction, and the location of communication devices and safety equipment.

12.1 GENERAL HEALTH AND SAFETY PROGRAM ELEMENTS

12.1.1 Hazard Communication Program

MWH has a written Hazard Communication Program. This program appears as MWH H & S Policies Procedure No. 1000. A copy of this will be available to field personnel. As necessary, the hazard communication program of subcontractors also will be solicited for use as a project reference. MWH and subcontractor field personnel will be made aware of the MWH Hazard Communication Program and have access to MSDSs for any chemicals brought to field sites. MWH will be responsible for supplying MSDSs and each field team will have them in their possession when in the field.

12.1.2 Sanitation

Work breaks, eating, drinking, and paperwork tasks will be performed in the field vehicle or other suitable location away from sampling location. Field personnel will wash or otherwise sanitize their hands prior to eating or drinking.

The OSO is responsible for ensuring that an adequate supply of water is available at the site. During times of heavy labor and hot temperatures, it is recommended that approximately one liter of water per hour be ingested. Sport-type beverages also may be provided for field personnel. It is to be assumed that there is no potable water in the field. When decontamination procedures interfere with the ability of field personnel to obtain sufficient drinking water, personnel may drink water without prior personnel decontamination under the following stipulations:

- Water is dispensed from a cooler with a pull-lever pouring spout. Push-button pouring spouts are unacceptable, as dirty fingers can easily contaminate the pouring spout.
- Minimum three-inch tall disposable drinking cups must be used and discarded after each use.
- Drinking cups must be dispensed out of a plastic or metal dispenser attached to the cooler, allowing the bottom of the cup to be grabbed without touching the top rim.
- Bottled water or sports drinks with removable caps, taking care not to touch the drinking surface with potentially contaminated hands.

12.1.3 Illumination

All site work will be done during daylight hours, with the exception of driving to and from the work site.

12.1.4 Standard Emergency Hand Signals

Team members should be familiar with the following emergency hand signals:

- Hand gripping throat: “Respirator problems, can’t breathe.”
- Grip team member’s wrist or place both hands around waist: “Leave site immediately; no debate!”
- Thumbs up: “OK, I’m all right; I understand.”
- Thumbs down: “No, negative.”
- Hands on face: “Put on respirator.”

12.1.5 Fire Protection

Field activities performed during the summer at this location could potentially result in a fire at the site. Cigarette smoking is forbidden at any sampling locations and should be done with care otherwise (extinguished and disposed of properly). Driving off road should be avoided if possible, as vehicles driving over tall stands of brush and grasses can easily spark a fire.

Electrical wiring will be free from frayed ends and sections, and hook-ups will be checked for loose fittings. Portable power tools will be connected to a ground fault circuit interrupter, and care will be taken to ensure that electrical connections do not exceed the maximum load capacity for any one circuit.

12.1.5.1 Wildfires

Wide open areas of natural brush present the danger of wildfires. Many project sites have structures that can provide enough of a fire break to prevent a wildfire from endangering field personnel, but such a structure does not provide absolute protection. The MWH OSO will therefore check regularly with the local fire department during the most common wildfire months of July through November. Should a wildfire threaten a work site, the MWH OSO will watch for changing conditions and evacuate and secure each active site, in accordance with local fire department instructions.

12.1.5.2 Fire or Explosion Response Action

The actions listed below are in a general chronological sequence. Conditions and common sense may dictate changes in the sequence of actions and the addition, elimination, or modification of specific steps.

Immediate Action. Upon detecting a fire/explosion, employees will notify the fire department and determine whether or not the fire is small enough to extinguish readily with immediately available portable extinguishers or water, or if other fire-fighting methods are necessary. Non-essential personnel will be directed away from the area of the fire. If it is judged that a fire is small enough to fight with available extinguishing media, employees will attempt to extinguish the fire provided that:

- They have been properly trained on the use of the specific fire extinguisher to be used.
- They are able to approach the fire from the upwind side, or opposite to the direction of the fire’s progress.
- The correct extinguisher is readily available.
- No known complicating factors are present, such as likelihood of rapid spread, imminent risk of explosion, or gross contamination.

Personnel leaving a fire/explosion area will notify the fire department and will account for employees in that area as soon as possible. The OSO or designee will perform a head count of sampling team members.

Notification. The MWH OSO will be notified as soon as possible of the location, size, and nature of the fire/explosion. A member of the MWH management team will notify appropriate agency personnel in the event of a fire or explosion resulting in a release of a hazardous material to the environment. As conditions dictate, the OSO will declare an emergency, initiate the remedial procedures, request assistance from the fire department, and make the necessary on-site and off-site notifications. If assistance from the fire department is required, an escort appointed by the OSO will direct responders' vehicles over clean roads to the extent possible to limit contamination. Note: National Fire Protection Association (NFPA) guidelines call for notifying the fire department, even for small fires, to ensure proper handling.

Rescue. If personnel are unable to evacuate themselves from a fire/explosion area for any reason, their rescue will be the first priority of responders. The FTL and/or OSO will determine whether on-site resources are sufficient to proceed, or if rescue must be delayed until outside responders arrive. **Field personnel are not to take any actions which place themselves or other in danger and/or for which they have not been properly trained.**

Fire-Fighting Procedures. Planned fire-fighting procedures are described below. These apply to small fires that the project personnel are able to control.

Fire During Working Hours: In the event that a fire occurs during working hours, the following measures will be taken to put out the fire provided that the person is properly trained to do so. These measures are sequential, that is, if the first measure does not succeed in containing the fire, the next measure will be initiated.

- Use fire extinguishers.
- Confirm that request for assistance from the fire department has been made.
- Utilize earth moving equipment, foam unit, and water truck, as appropriate. Brush fires will be extinguished with water.

Fire During Non-Working Hours: In the event of a fire during non-working hours, existing alarms, site security (if applicable), or whomever from the project team is notified, will notify the MWH OSO or PSO. Additional actions will be consistent with procedures established for a fire during working hours.

Response Coordination. Upon arrival of outside responders from the fire department, the OSO will coordinate with the leader of the outside responders to direct fire-fighting activities; however, the control of the scene is now the responsibility of the leader of the outside responders.

Protection of Personnel. The primary methods of protecting personnel from fire conditions will be by distance and remaining upwind. Based on the conditions, the OSO will determine appropriate distances and the selection of personal protective equipment for field personnel.

Decontamination. At the conclusion of fire fighting activities, the OSO will:

- Determine to the extent practicable the nature of the contaminants encountered during the incident.
- Arrange for outside responders' fire response equipment, and on-site equipment as necessary, to be processed through decontamination, using methods appropriate for the contaminants involved.
- Equipment not easily decontaminated shall be labeled and isolated for further action, such as determining specific contaminants by wipe sampling or awaiting the delivery of specific decontamination media and supplies.

Fire Extinguisher Information. The four classes of fire, along with their constituents, are as follows:

Class A - Wood, cloth, paper, rubber, many plastics, ordinary combustible materials.

Class B - Flammable liquids, gases, and greases.

Class C - Energized electrical equipment.

Class D - Combustible metals such as magnesium, titanium, sodium, and potassium.

Examples of proper extinguishing agents are as follows:

Class A - Water
Water with one percent AFFF Foam (wet water)
Water with five percent AFFF or Fluoroprotein Foam
ABC Dry Chemical
Halon 1211

Class B - ABC Dry Chemical
Purple K
Halon 1211
Carbon Dioxide
Water with six percent AFFF Foam

Class C - ABC Dry Chemical
Halon 1211
Carbon Dioxide

Class D - Metal-X Dry Chemical

No attempt should be made to extinguish a large fire. Large fires should be handled by the fire department. The complete area of the fire should be determined. If human life appears to be in danger, or the spread of the fire appears to be rapidly progressing, move personnel further upwind and away from the fire. Do not attempt to extinguish even a small fire if you have not been properly trained to do so.

Use of Fire Extinguishers. Inspect the fire extinguisher on a monthly basis to ensure that the unit is adequately charged with extinguishing media. Do not store a fire extinguisher on its side. To use the extinguisher, follow the acronym PASS for instructions listed below:

1. **P**ull the pin on the top of the unit.
2. **A**im at the base of the fire.
3. **S**queeze the handle on the top of the unit.
4. **S**weep the extinguishing media along the base of the fire until the fire is out. Ensure that the fire is fully cooled before assuming it is completely extinguished.

12.1.6 Earthquake and Disaster Preparedness

If an earthquake or natural disaster occurs during working hours and the magnitude is such that field personnel may be in danger, the MWH OSO will initiate the site evacuation procedure. This action is to be taken only if in the judgment of project personnel and/or OSO the earthquake is large enough to have potentially caused damage to any of the structures or equipment being used on the site. If the earthquake or disaster occurs during non-working hours, the OSO will determine whether safe entry onto sampling locations can be made, or if an inspection is needed first. If at any time the inspection team feels that they need the assistance of the fire department, the inspection shall cease until the fire department is able to assist. The inspection will be conducted using the buddy system. The team will look at structures, equipment, and any chemical storage areas for signs of cracks or deterioration. When assessing areas known to contain chemicals, appropriate air monitoring equipment will be used to ensure that leaks are detected quickly and without injury to the inspection team. When inspecting areas where chemical releases could have occurred as a result of a breach of containment, Level B PPE is recommended.

12.2 COMMON PHYSICAL HAZARDS AND CONTROLS

This section provides information concerning the common physical hazards associated with site investigations and recommended controls to minimize risk to field personnel. Section 2.0 and Appendix A list the physical hazards specific to this project.

12.2.1 Slip/Trip/Fall

Field personnel are to be vigilant in providing clear footing, clearly identifying obstructions, holes, or other tripping hazards and maintaining an awareness of uneven terrain and slippery surfaces. It is necessary that shoes providing more elaborate tread be worn to minimize slip, trip and fall hazards.

12.2.2 Heavy Lifting

During manual lifting tasks, personnel will remember to lift with the force of the load suspended on their legs and not their backs. They are to maintain a straight back and hold the object close to the body. Mechanical lifting devices or the help of a fellow field team member should be sought when the object is too heavy for one person to lift.

12.2.3 Motor Vehicle Hazards

Motor vehicle accidents can occur any time people drive. Field personnel are required to employ defensive driving techniques, and obey site speed limits and vehicle safety requirements. Accidents are to be reported to the MWH OSO. Working in an active mine area poses unique hazards to personnel whether in a vehicle or as a pedestrian. Mine equipment, especially haul trucks, are often large, may operate at relatively high rates of speed, often have limited visibility, and cannot stop or maneuver like over-the-road vehicles. Unique mine driving rules often apply within a local mine that are different from public road rules. Haul trucks within a mine area often have the right-of-way in every instance. Therefore, it is extremely important that while walking or driving within an active mine area, to be exceptionally alert to all traffic around you. When in doubt, yield the right-of-way. **Field personnel are required to wear seatbelts at all times when in a moving vehicle and the driver must refrain from using his/her cell phone.**

12.2.4 Sharp Edges and Pinch Points

During the course of this site investigation, it is feasible that personnel will encounter sharp edges and pinch points. Sharp objects may include site debris, field tools, equipment, or other objects. Pinch points are places where the hands may be caught between objects or moving parts. When danger of cuts to the hands or other body parts is probable, employees will either arrange paths where personnel may walk without encountering sharp edges, or will ensure during the tailgate safety meeting that areas with known sharp edges are brought to the attention of field personnel. Heavy work gloves shall be used in conjunction with any chemical resistant gloves in circumstances where handling sharp objects are required.

12.3 SEVERE WEATHER

While each project site will be subject to varying types of weather conditions, this section provides general information and controls on several types of severe weather.

12.3.1 Lightning

If a lightning storm is suspected or observed, site activities must be stopped, and site equipment must be evaluated for its potential for acting as a lightning rod. Personnel should wait indoors for the storm or lightning event to end. If the strike of lightning occurs and personnel are out in the field, the response should be to disband from one another and lay low to the ground by dropping to your knees and bending forward with your hands wrapped around your knees, away from any poles or trees.

Persons struck by lightning will receive a severe electrical shock and may be burned, but they carry no electrical charge and can be handled safely. Someone who appears to have been killed by lightning often can be revived by prompt action. Those unconscious but breathing probably will recover spontaneously. First aid and CPR should be administered as appropriate until medical assistance arrives. Realize that victims who appear to be only stunned or otherwise unhurt also need attention. Check for burns, especially at fingers and toes and next to metal buckles, jewelry, or personal items that the victim is wearing. Remember to treat for shock.

12.3.2 Tornadoes

Tornadoes usually develop from thunderstorms and normally occur at the trailing edge of the storm. Most tornadoes occur in the months of April, May, June, and July in the late afternoon and early evening hours.

When storms are predicted for the project areas it is necessary to monitor weather conditions on a radio. A <u>tornado watch</u> is issued when favorable conditions exist for the development of a tornado. A <u>tornado warning</u> is issued by the local weather service office whenever a tornado has actually been sighted or is strongly indicated by radar.

If a <u>tornado warning</u> is issued, seek shelter immediately. If there are permanent buildings located on site, enter one immediately and move toward interior hallways or small rooms on the lowest floor.

If a <u>tornado warning</u> is issued and you are in a vehicle or a site trailer, leave and go to the nearest building. If there are no buildings nearby, go in the nearest ditch, ravine, or culvert, with your hands shielding your head.

If a tornado is sighted or a warning issued while you are in open country, lie flat in a ditch or depression. Hold onto objects secured to the ground, such as a bush or fence post, if possible.

Once a tornado has passed the site, field personnel are to assemble at the designated assembly area to determine if anyone is missing or injured. Administer first aid and seek medical attention as needed.

12.3.3 Winter Storms

When snow or ice storms are predicted for the project area, field personnel should monitor radio reported weather conditions. A <u>winter storm watch</u> is issued when a storm has formed and is approaching the area. A <u>winter storm warning</u> is issued when a storm is imminent and immediate action is to be taken.

When a storm watch is issued, monitor weather conditions and prepare to halt site activities. Notify the Project Manager or FTL of the situation. Seek shelter at site buildings or leave the site and seek warm shelter.

If you are caught in a severe winter storm while traveling, seek warm shelter if road conditions prevent safe travel. If you are stranded in a vehicle during a winter storm:

- Stay in the vehicle. Disorientation comes quickly in blowing and drifting snow.
- Wait for help.
- Keep a window open an inch or so to avoid carbon monoxide poisoning.
- Run the engine and heater sparingly.
- Keep watch—don't let everyone sleep at the same time.
- Exercise occasionally.

12.4 ENGINEERED CONTROLS

Where economically and practically feasible, engineered controls may be selected to reduce exposure of field personnel to health or safety hazards. The OSO and FTL should always be on the lookout for potential engineered controls that may be implemented.

12.5 ADMINISTRATIVE CONTROLS

When engineered controls are not feasible, administrative controls in the form of work practices will be implemented to minimize risk to personnel from site hazards. Work practices that may be instituted include removing non-essential personnel from sampling areas and work rotation to control exposures to extreme thermal stress.

Appendix A
Activity Hazard Analysis

This page was intentionally left blank.

Tasks	Hazards	Controls	PPE Required
Sampling at Operating Mine Sites (including sites undergoing reclamation)	• Cuts and scrapes	• Follow procedures of mine operator. Report injuries to buddy or to person designated by mine operator for first aid if necessary. • Come to work alert and ready—make sure that general awareness of surroundings is part of job planning and execution. • Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground.	Minimum: hard-hat, safety glasses, boots, long pants, and cotton shirt; heavy work gloves for handling sharp objects. Additional PPE as specified by the mine operator.
	• Heat or cold stress	• Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0).	
	• Slips/trips/falls	• Maintain general awareness of surroundings.	
	• Being struck by heavy equipment or caught between equipment and a stationary object	• Receive site-specific hazard training. • Be alert to the direction of traffic flow. • Maintain eye contact with heavy equipment operators and give them the right-of-way. • Never stand between operating vehicles and nearby stationary objects. • Ask the mine operator where the blind spots for each piece of equipment are located—DO NOT STAND IN BLIND SPOTS.	

Tasks	Hazards	Controls	PPE Required
Sampling at Operating Mine Sites (continued)	• High wall collapse	• Receive site-specific hazard training. • Perform work under escort of mine employee. • Do not stand between high wall and heavy equipment—make sure you have an escape route. • Know the mine emergency signals and evacuation procedures.	
Sampling at Inactive Mine Sites	• Cuts and scrapes	• Report injuries to buddy for first aid if necessary. • Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. • Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground.	Minimum: hard-hat, boots, long pants, and cotton shirt; heavy work gloves for handling sharp objects.
	• Slips/trips/falls	• Do not walk at the edge of sharp drop-offs. Maintain special care on scree slopes or while working in other areas with unstable footing. Maintain general awareness of surroundings. • Be aware of the possibility of abandoned underground mine portals.	
	• Dislodged rocks	• Avoid areas below people who may dislodge rocks while working or walking on slopes. Cry "ROCK" after dislodging a rock when other people are below.	

Tasks	Hazards	Controls	PPE Required
Sampling at Inactive Mine Sites (continued)	• Deteriorated roads	• Receive site-specific hazard training. • Exercise care while traveling by vehicle.	
	• High wall collapse or rock-fall	• Receive site-specific hazard training. • Know signs of instability. Carefully examine the surroundings to determine if entry is safe. • Be aware of the most efficient evacuation route. • Do not walk on top of high walls. • Avoid working downslope of rock slides.	
	• Falling into standing water in mine pits, ponds, or reservoir	• Sample from a safe, stable location at water level. Personnel will not be belayed without prior discussions with the Project Safety Officer regarding proper procedures for using harnesses. • If it is necessary to enter standing water, first measure the pH. Personnel will not enter the water if the pH is less than 4 or is greater than 10. • If the pH is greater than 2 but less than 4, or is greater than 10 but less than 12, sampling may be conducted from a raft or similar device. Samples will be collected only from the land if the pH is less than 2 or greater than 12.	Life vest if sampling from a raft in water over five feet deep.

Tasks	Hazards	Controls	PPE Required
Sampling at Inactive Mine Sites (continued)	• Heat or cold stress • Drinking water from mine pits	• Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0). • Water in mine pits is of unknown quality, and WILL NOT be used for drinking water. Water purification with iodine, filters, or boiling will not remove potentially toxic metals.	
Sampling Rivers and Streams	• High Water	• Inspect the river to ensure that it is safe to enter. Fast-moving water should not be entered if more than knee-high. • If the stream bottom is not visible, probe with a stick to check the water depth. • Be watchful for logs and other debris coming from upstream. • If you should fall into a river or stream, float downstream feet first to avoid head injury. • Wear specified PPE.	Minimum: hip boots Additional: chest waders, life vest (depending on water depth).
	• Hypothermia	• If you should fall into a river, change into dry clothes as soon as practicable. • If exhibiting signs of hypothermia, drink hot liquids and move to a warm place, such as the inside of a vehicle. A person continuing to exhibit signs of hypothermia should be taken to the hospital (also, see Section 7.0).	

Tasks	Hazards	Controls	PPE Required
Travel in Remote Areas	• General	• Always carry ten essentials for wilderness travel (see Table 2-3).	Heavy work gloves for handling sharp objects.
	• Slips/trips/falls	• Maintain general awareness of surroundings.	
	• Cuts and scrapes	• Report injuries to buddy for first aid. Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. • Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground.	
	• Safe drinking water	• Contact National Forest officials in advance regarding any water quality advisories. • Bring sufficient water. Assume that you will need one gallon of drinking water per person per day.	
	• Severe weather	• Bring proper rain gear and warm clothes. • Listen to weather forecasts before entering remote areas. If severe weather is likely, postpone sampling. • In case of lightning, avoid high ground and open areas. • In the event of rain, monitor for hypothermia.	

Tasks	Hazards	Controls	PPE Required
Travel in Remote Areas (continued)		• In the event of snow, monitor for frostbite and hypothermia. In the event of a blizzard that reduces visibility, stay put in an emergency shelter. Do not risk disorientation.	
	• Getting lost	• Provide the Program Manager or designee with itineraries, including travel routes and the expected date and time of return. Check in once per day, if possible, when in remote areas. Always check in with the Program Manager or designee before and after sampling. The Program Manager or designee will contact search and rescue if field personnel do not return or call in by the specified time. • Bring emergency shelter. • If lost, stay put. You are easier to find this way.	
	• Heat or cold stress	• Monitor for heat or cold stress as outlined in the Health and Safety Plan (see Section 7.0).	
	• Muscle strains	• Know your limits, and do not overextend yourself.	

Tasks	Hazards	Controls	PPE Required
Travel in Remote Areas (continued)	• Poisonous plants and animals	• Be able to recognize poisonous plants and animals and avoid them. • If bitten by a snake or spider, apply cold compresses. Get to a hospital as quickly as possible.	
	• Wildlife	• Avoid, if possible, and leave the area. Do not approach game animals within 25 yds and bears/wolves/mountain lions with 100 yds. • Make yourself look large by raising arms and shouting. • Slowly back away, without turning your back to the animal.	
General Work Practices	• First aid injuries	• Report injuries to buddy for first aid. • Seek additional medical attention, if necessary. • Notify the PSO.	Minimum: hard-hat, safety glasses, boots, long pants, and cotton shirt.
	• Slips/trips/falls	• Practice good housekeeping, and remove or reduce slip/trip/fall hazards. • Maintain general awareness of surroundings.	Additional: heavy work gloves and hearing protection, as necessary.
	• Cuts/scrapes	• Report injuries to buddy for first aid. • Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution.	

Tasks	Hazards	Controls	PPE Required
General Work Practices (continued)		• Wear heavy work gloves when handling sharp objects and point sharp objects towards the ground.	
	• Heat or cold stress	• Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0).	
	• Muscle strain	• Alternate activities as needed to give muscles rest.	
	• Slips/trips/falls	• Practice good housekeeping to remove or reduce slip/trip/fall hazards.	
	• Hearing loss	• Use hearing protection when operating loud equipment.	
	• Electrocution	• Use GFCI on portable power equipment.	
	• Power equipment	• See manufacturers instructions for the use of hand and portable power tools.	
	• Severe weather	• Bring proper rain gear and warm clothes. • In case of lightning, avoid high ground and open areas. • In the event of rain, monitor for hypothermia. • In the event of snow, monitor for frostbite and hypothermia.	

Tasks	Hazards	Controls	PPE Required
General Sampling Safety	• Chemical Hazards	• Always wear nitrile gloves and safety glasses when calibrating instruments, taking field nitrite and ferrous measurements, and taking samples using nitric acid preserved bottles.	Nitrile gloves and safety glasses.
Well Sampling	• Cuts and scrapes and pinch points	• Report injuries to buddy for first aid. Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. • Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground. • Maintain general awareness of potential pinch points.	Heavy work gloves for handling sharp objects and possible pinch points.
	• Slips/trips/falls	• Practice good housekeeping, and remove or reduce slip/trip/fall hazards. • Maintain general awareness of surroundings.	
	• Nitrogen cylinders	• Store upright and keep valves closed when not in use. • Do not drag, drop, or roll, and always move using a hand truck.	
	• Portable gas powered generator	• Use only in wide open spaces. • Allow generator to cool before refueling. • Store fuel in flammable liquid safety cabinets only.	

Tasks	Hazards	Controls	PPE Required
Well Drilling and Installation Supervision	• Slips/trips/falls	• Practice good housekeeping, and remove or reduce slip/trip/fall hazards. • Maintain general awareness of surroundings.	Hardhats, safety glasses, and hearing protection.
	• Hearing loss	• Use hearing protection when operating, or in the vicinity of, loud equipment.	
	• Drilling debris	• Always wear safety glasses and hard hat to protect from flying debris.	
	• Loss of limb	• Keep hands away from moving machine parts.	
	• Heat or cold stress	• Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0).	

Appendix B
Emergency Contacts

This page was intentionally left blank.

EMERGENCY SERVICES

Security (Police/Sheriff)	911
Fire/Rescue	911
Ambulance	911
Caribou Memorial Hospital Emergency Room	208-547-3341
Portneuf Medical Center Emergency Room (Pocatello)	208-239-1800
Star Valley Hospital Emergency Room (Afton, WY)	307-885-5821
Idaho Poison Control Center	800-860-0620

EMERGENCY CONTACT NUMBERS

Cary Foulk (MWH Project Manager and SBS-1 office contact)	office: 970-879-6260 cell: (b) (6) [redacted]
Bill Wright (SEA-5 office contact)	cell: (b) (6) [redacted]
Colin Duffy (MWH Program Safety Officer, On Site Safety Officer)	cell: (b) (6) [redacted]
Dean Brame (MWH Field Team Leader)	cell: (b) (6) [redacted]
Barry Koch (P_4 Production Project Manager)	office: 208-547-1439 cell: (b) (6) [redacted]
Paul Stenhouse (P_4 Production on-site safety specialist)	office: 208-574-1294 cell: (b) (6) [redacted]
Emergency	911

Note: It may be necessary to dial a '9' to access an outside line at mine sites when calling.

HOSPITAL FACILITIES

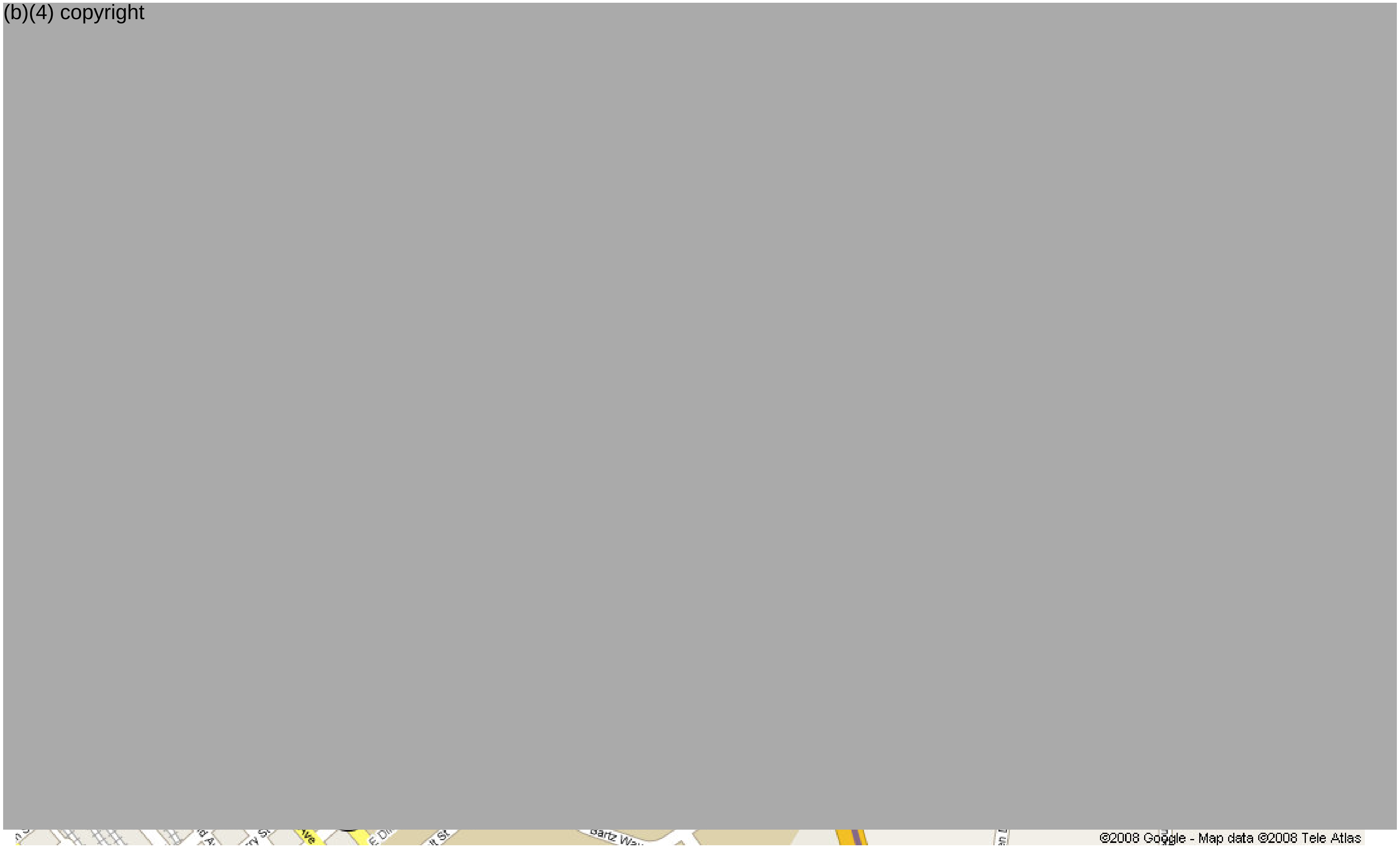
The closest hospital and the specific route to the hospital will depend on where field activities are taking place. The following are the hospitals closest to the project sites:

Caribou Memorial Hospital, 300 South 3rd West, Soda Springs, Idaho

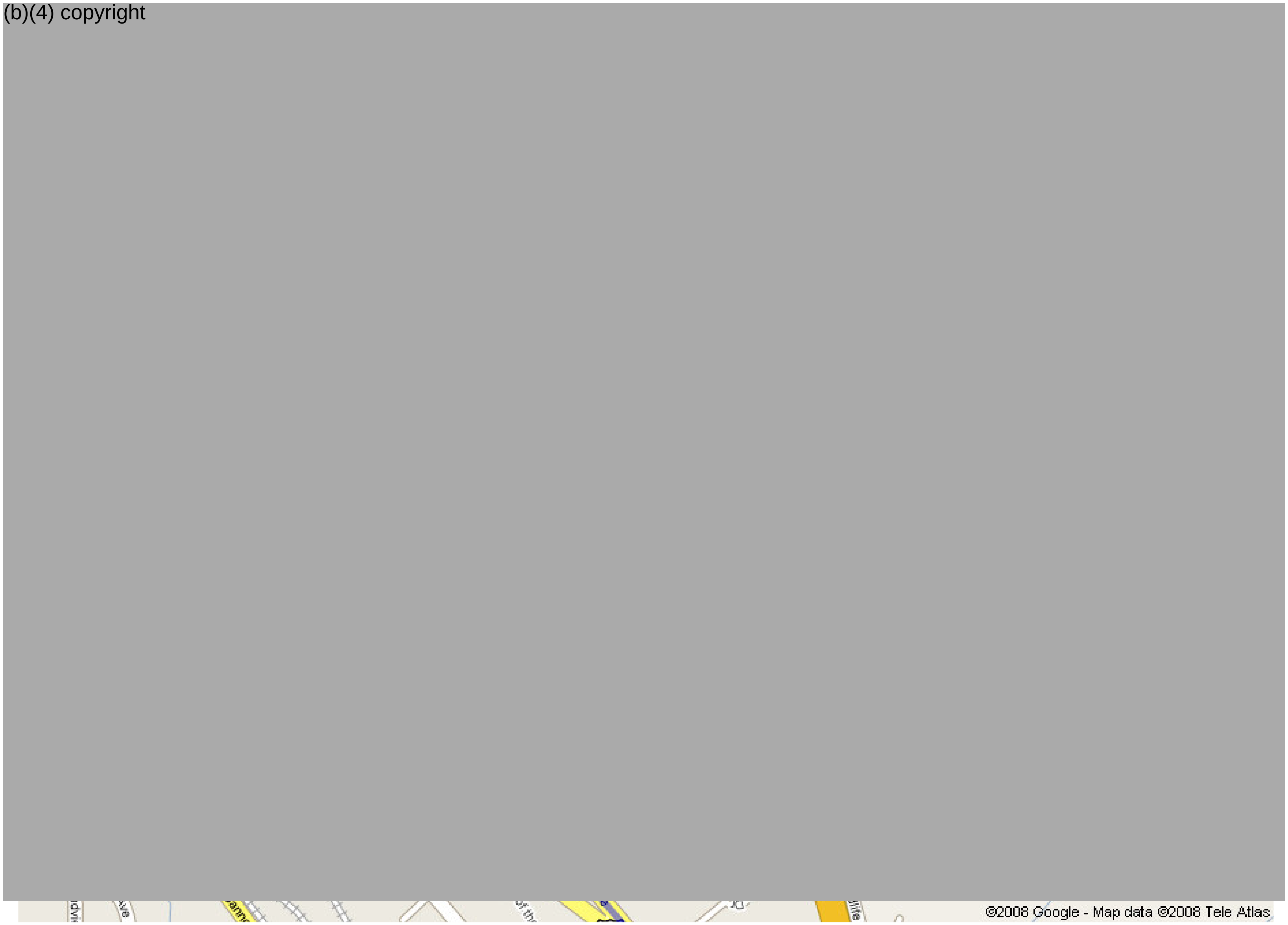
(b)(4) copyright

Portneuf Medical Center (East Campus), 777 Hospital Way, Pocatello, Idaho, At Pine Ridge Mall

(b)(4) copyright



Portneuf Medical Center (West Campus), 651 Memorial Drive, Pocatello, Idaho



Star Valley Medical Center	307-886-5800 (Information)
110 Hospital Lane	307-886-5821 (Emergency Room)
Afton, Wyoming	911 (Search and Rescue/Sheriff's Dispatch)

In general, to get to the Caribou Memorial Hospital, proceed to Highway 30 in Soda Springs, which is also known as 2nd South. Proceed to 3rd West, and turn south to 3rd South. To get to the Portneuf Medical Center (East Campus), proceed to I-15 and take the Clark Street exit. The hospital is at the top of a hill and is visible from the freeway. To get to the Portneuf Medical Center (West Campus), proceed to I-15 through Pocatello and take the Clark Street exit. Drive West on Clark, turning South on 15th Street. The West Campus is on the right side. To get to the Star Valley Hospital, proceed to Highway 89 and turn onto Hospital Lane. When making calls from mine offices, it may be necessary to dial '9' to access an outside line.

This page was intentionally left blank.

Appendix C
Acknowledgement Form

This page was intentionally left blank.

PERSONAL ACKNOWLEDGMENT FORM

HEALTH AND SAFETY PROGRAM

____
PROGRAM OR SITE

As a component of the Health and Safety Plan designed to provide personnel safety during the investigation of the southeast Idaho phosphate resource area, you are required to read and understand the Health and Safety Plan. When you have fulfilled this requirement, please sign and date this personal acknowledgment form, and return the form to the On-Site Safety Officer.

______________________________	______________________________
Signature	Name (Printed)

____
Date

This page was intentionally left blank.

This page was intentionally left blank.

Monsanto – Soda Springs Plant

Pre-Job Risk Analysis

Job #	
Date:	
Work Area:	

Work area inspected and the following hazards corrected:	

Work Team Signatures:				

Job Name/Title:	

Major Job Steps (Each major step is written below in this column)	**Potential Risks** (Run each job step thru the following list, identifying risks by entering the job step number from the prior column)	**Prevention Plan** (All risks identified from the previous column must have a prevention plan noted here, and detailed on the job order)
1.	Lockout/Tagout	
	Atmospheric Monitoring	
2.	Barriers/Guards	
	Housekeeping	
3.	Permitting	
	Head/face/neck protection	
4.	Eye Protection	
	Body Protection	
5.	Hand/Arm Protection	
	Legs/Feet Protection	
6.	Respiratory Protection	
	Fall Protection	
7.	Hearing Protection	
	Pinch Points	
8.	Lifting	
	Ascend/Descend	
9.	Line of Fire	
	Working Surface	
10.	Ergonomics	
	Work Pace	
11.	Tool Selection/Condition	
	Vehicle Inspection	
12.	Vehicle Operation	
	Assistance	
13.	Communication	
	Environmental Risks	
14.	Chemical Safety/MSDS	
	Electrical Clearance	

This page was intentionally left blank.

Appendix E
Occupational Incident Report Forms and Procedures

This page was intentionally left blank.

402 OCCUPATIONAL INJURY/ILLNESS REPORTING AND INVESTIGATION

I. PURPOSE

To set forth the essential components and responsibilities for implementation of the MWH accident investigation procedure. Accidents are investigated to identify unsafe conditions and acts which contribute to injury, illness, and/or property damage so that solutions for accident prevention may be developed.

II. ATTACHMENTS

Incident Reporting Process flowchart
MWH Occupational Incident Report Form (OIR)
Vehicle Accident Report Form (VAR)

III. DISCUSSION

Effective accident investigations lead to procedures which can reduce or eliminate occupational injuries and illnesses. It is important for MWH management and employees to understand and comply with the accident investigation procedures.

IV. DEFINITIONS

Accident/Incident: is an occurrence in a sequence of events that usually produces unintended injury or illness, or death, and/or property damage.

First Aid: is any one-time treatment and any follow up visit for the purpose of observation of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care, but may be administered by a physician.

Near-Miss Situations: are accidents without injury, illness or property damage, but have the potential for serious harm.

V. PROCEDURE

A. GENERAL

Every accident/incident, regardless of whether it results in injury, property damage, or a near miss, should be investigated to determine the actual cause and to take proper action to prevent recurrence. The attached flow chart presents a schematic representation of the incident reporting process.

It is the responsibility of the Business Unit Manager to assure that a thorough investigation into the cause of each employee injury occurs immediately after the event, and to initiate corrective action to prevent a similar recurrence.

The Business Unit Manager must ensure that accidents/incidents are reported to the company health and safety manager to comply with the Occupational Safety and Health Administration (OSHA) recordkeeping/reporting requirements for occupational injuries and illnesses (see MWH Safety and Health Policies No. 403).

It should be noted that incidents resulting in a fatality or the hospitalization of 4 or more people must be reported to the local OSHA office within 8 hours of the incident. It is preferable for the company health and safety manager to place the report with OSHA, however, if the health and safety manager is not available, the most senior MWH person at the scene of the incident shall make the report. Contact the local telephone information service to obtain the OSHA phone number.

B. ACCIDENT/INCIDENT INVESTIGATIONS

Once an accident occurs (whether it involves personal injury or illness, property damage or is a near miss), whether the victim is a MWH employee, contractor, or visitor, the below listed procedures are to be carried out.

1. Attend to the victim's medical needs.
2. Secure the accident/incident area.
3. Complete the MWH Occupational Incident Report Form.
4. Assemble the personnel and tools needed to perform an accident investigation.
5. Call the Health and Safety Coordinator or Health and Safety Manager **immediately** after the scene is secure, to report the accident and to initiate workers compensation coverage, if needed.
6. Begin the accident investigation.

C. MWH OCCUPATIONAL INCIDENT REPORT FORM

The MWH Occupational Incident Report Form (OIR), Attachment A, shall be completed by the designated MWH employee representative after an employee injury occurs. Each section of the report should be addressed and completed or marked "na" for not applicable. The degree of detail in the report and any additional data should be commensurate with the degree of the incident. That is, the report should be simple and concise for a twisted ankle resulting from someone tripping out of a van. The report should be detailed with additional background for a near miss that resulted from a pressure grout packer being expelled from a well which could have caused a fatality.

If the incident was involving a vehicle, private, company owned/leased, or rented, or other, the attached Vehicle Accident Report Form (VAR) should be completed.

Note: Forms that provide essentially the same information may be used in lieu of the MWH form. Regardless of which form is used, the distribution stated on the MWH form must be used.

The OIR and VAR shall be promptly submitted to the Health & Safety Coordinator and to the Company Health & Safety Manager.

D. ACCIDENT INVESTIGATION REPORT FORMAT

The various sections of the OIR are intended to clearly identify the incident, describe its cause(s), and insure that information is gathered that can be used to prevent recurrence, either for this particular instance, or similar situations. While the OIIIR is basically self-explanatory, it is important that the persons completing and reviewing the form observe the following:

1. Do not speculate as to the facts, nor make unsubstantiated accusations. We all, however, are free to make reasonable assumptions based on a good faith understanding of the facts at hand. Remember that this form becomes an official, MWH legal document.

2. Handle any samples or physical evidence with care, insuring against even inadvertent tampering.

3. Keep all handwritten notes used in gathering the facts of the case in the office master file, along with the completed OIR. Raw data and notes may be helpful in a possible future evaluation.

E. RECORDKEEPING

Insure prompt distribution of complete OIR, i.e. within 24 hours, to:

1. Company Health & Safety Manager
2. The Local Health and Safety Coordinator
3. The Business Unit Manager or Program Director
4. The Direct Supervisor of the affected employee or project

VI. <u>REFERENCES</u>

A. Title 29, Code of Federal Regulations, Part 1904

B. Various States' Labor, Health and Safety, and Workers' Compensation Codes

Incident Reporting Process
Work-Related Injury / Illness or Vehicle Accident

1. Employee(s) should seek necessary medical attention as appropriate:
   (a) On-site first aid; (b) emergency room-eg., identified in safety plan; (c) via 911-transport by ambulance if there is any uncertainty about severity of injury; (d) designated occupational health clinic near injured employee's office; (e) pre-designated personal physician. ***Tell medical personnel this is a work-related incident. If medical provider asks for a claim number, inform them that a claim number is in process.***

2. MWH Employee(s) should notify their supervisor as soon as possible. The MWHA employee or supervisor should contact EH&S Administrator at 303.410.4138 (Work Hours MST) or 866-4MWHGLO (866.469.4456) after hours.

3. The MWH Occupational Incident Report Form and /or Vehicle Accident Report Form must be completed within 24 hours, preferably ASAP. Submit the form(s) to the EH&S Administrator by Fax (303.410.4196) or e-mail to MWHEHS@mwhglobal.com.

4. Ensure that any client or state specific forms and notifications are completed.

Incident/Injury

INCIDENT OCCURS

Vehicle Accident

Employee Immediately notifies their **Supervisor**

Supervisor
1. Assist Injured Employee in obtaining approved Medical Provider.
2. Facilitate transportation of Injured Worker.
3. Follows Operations Specific Report

If Injury Occurred

Employee or Supervisor Call the EH&S Administrator
303.410.4138 (Work Hours)
866.4MWHGLO
(866.469.4456)

EHS Administrator Notifies Work Comp Carrier and if necessary MWH Human Resources (HR)

1. MWH driver completes a vehicle accident report form or in a MWH Vehicle, use the Accident Kit and submit forms to EH&S.
2. If another driver is involved the MWH employee driver must also report the claim to the other drivers Insurance Company as required.
3. Follow any additional reporting requirements, which may apply for personal autos, rented, or leased vehicles.

If injury results in "lost time", (away from work) Employee will be contacted by HR and EH&S to develop approved Return to Work Plan. Injured worker will participate in RTW program developed jointly by HR, EHS and Benefits.

Supervisor/Employee
Complete and Submit Occupational Incident and/or Vehicle Accident Report Forms

Forms available on KNet EH&S website

MWH driver provides the information to adjustors, etc. as needed to settle claims.

For questions or assistance, contact the MWH Insurance Administrator 303.410.4111 or the Legal Counsel for you BU.

OCCUPATIONAL INCIDENT REPORT FORM

MWH

EMPLOYEE INFORMATION (Electronically, double click to the left of the box, click checked under default value)

NAME			DATE OF REPORT	
OFFICE ADDRESS		OFFICE PHONE	HOME ADDRESS	HOME PHONE
MWH EMPLOYEE (If not MWH employee provide company, address, phone) ☐ YES ☐ NO			BUSINESS UNIT	
JOB TITLE	HIRE DATE	BIRTHDATE	SOCIAL SECURITY NO.	GENDER ☐ M ☐ F
SUBCONTRACTOR INVOLVED (If yes, provide company, address, phone) ☐ YES ☐ NO				

INCIDENT INFORMATION

LOCATION (Name of facility or location identification, address, specific site)	
DATE AND TIME INCIDENT OCCURRED	EMPLOYEE's WORK SCHEDULE ON DATE OF INCIDENT
TYPE OF INCIDENT: ☐ INJURY ☐ PROPERTY DAMAGE ☐ OTHER INCIDENT ☐ ILLNESS ☐ NEAR MISS	

What was the employee doing just before the incident occurred? Describe the activity, as well as the tools, equipment, or material the employee was using. Be specific. Examples: *climbing a ladder while carrying roofing materials; daily computer key-entry.*

What happened? Tell us how the injury occurred. Examples: *when ladder slipped on wet floor, worker fell 4 feet; worker developed soreness in wrist over time.*

What was the injury or illness? Tell what part of the body was affected and how it was affected. Be more specific than "hurt," "pain," or "sore." Examples: *strained back; carpal tunnel syndrome.*

What object or substance directly harmed the employee? Example: *concrete floor; radial arm saw.*

OCCUPATIONAL INCIDENT REPORT FORM

INJURY/ILLNESS TREATMENT INFORMATION

INJURY/ILLNESS TREATMENT:

☐ NOT APPLICABLE ☐ ON-SITE FIRST AID ☐ OFFERED & REFUSED

☐ OFF-SITE (If checked, list name of physician or other health care professional/facility, address, phone)

Was employee treated in an emergency room? ☐ YES ☐ NO

Was employee hospitalized as an in-patient? ☐ YES ☐ NO

Was this a fatality? ☐ YES ☐ NO Date of death_____________

WITNESS STATEMENTS ATTACHED: ☐ YES ☐ NO

Witness Names:

ANALYSIS OF CAUSES AND CORRECTIVE ACTIONS

WHAT CONDITIONS OR ACTIONS CAUSED OR CONTRIBUTED TO THE INCIDENT?

CORRECTIVE ACTIONS TAKEN OR RECOMMENDED (Describe):

DISTRIBUTION

(Supervisor and Business Unit Manger Print & sign name; Original is forwarded to ES&H Den-2)

1. EMPLOYEE or INDIVIDUAL REPORTED BY:	2. EMPLOYEE's DIRECT SUPERVISOR:
3. BUSINESS UNIT MANAGER:	4. HEALTH AND SAFETY: Claudia Kessack Den-2 Telephone: 303-410-4138 Emergency Only 866-469-4456 Facsimile: 303-410-4196 OSHA Log Case Number __________________

Note: *Attach additional sheets as necessary to document incident.*

VEHICLE ACCIDENT REPORT FORM

MWH DRIVER INFORMATION

Your Name

☐ Leased (US Fleet Leasing Vehicle Number)

Office Address

☐ Rented ☐ Company owned ☐ Other

City

Year/Make/Model

State ZIP

Age

Work Phone

Business Unit

Is Your Vehicle Driveable?

List Parts Damaged

MWH DRIVER'S INFORMATION

Driver's Name

Home Address

City

State ZIP

Home Phone

OTHER VEHICLE OWNER'S INFORMATION

Owner's Name

Street

City

State ZIP

License Plate Number

WITNESSES

Name

Address

City

State ZIP

Phone Number

OTHER VEHICLE OWNER'S INSURANCE

Insurance Company

Address

City

State ZIP

Policy Number Phone

INJURIES

Were You Injured? ☐ Yes ☐ No

Any Passengers Injured? ☐ Yes ☐ No

Was The Other Party Injured? ☐ Yes ☐ No

Any Of Thier Passengers Injured? ☐ Yes ☐ No

TYPE OF ACCIDENT

Collision With:

☐ Other Vehicle ☐ Animal

☐ Fixed Object ☐ Pedestrian

☐ Ran Off Road ☐ Hit And Run

☐ Other (Non-Hit And Run)

Manner Of Collision:

☐ Backing ☐ Head-On

☐ Side Swipe ☐ Angle

☐ Rear-End (We Hit)

VEHICLE ACCIDENT REPORT FORM

STATEMENT OF FACTS

Accident Date ________ Purpose Of Trip (Circle One) Business Pleasure

Accident Location Street ________ Urban Or Rural Area? ________

City ________ State ________ Zip ________

Was A Police Report Made? ☐ At Scene ☐ At Station ☐ None Report Number ________

Road Conditions ☐ Dry ☐ Wet ☐ Mud ☐ Snow ☐ Ice ☐ Cinders ☐ Other

SPEED OF VEHICLES

YOUR VEHICLE

Before Accident ________

At Impact ________

OTHER VEHICLE

Before Accident ________

At Impact ________

CITATIONS

Was A Citation Issued? ________

To Whom? ________

Nature Of Charge? ________

DRIVER OF VEHICLE (Other Than Assigned Under Lease)

Driver's Name ________

Street ________

City ________ State ________ ZIP ________

Relationship To Employee ________

MAIL OR FAX THIS REPORT TO

Claudia Kessack EH&S Administrator
Phone: (866)4MWHGLO
866.469.4456
Direct Number: 303.410.4138

DESCRIBE WHAT HAPPENED (Be Specific. Attach Additional Sheets If Necessary)

____

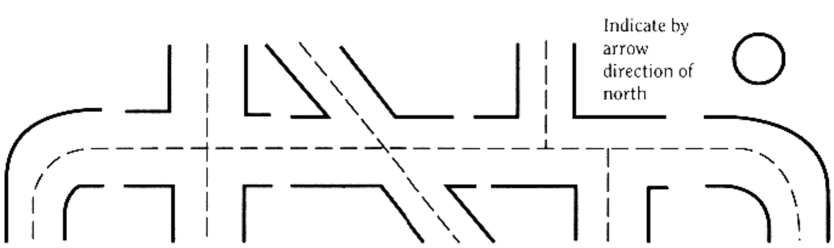
____

____

____

Signature ________ Date ________

ACCIDENT DIAGRAM



Diagram

Please draw what happened. Include signals and number the vehicles; #1 for your vehicle, #2 for other vehicle, etc.

Directions

Use solid line to show path of vehicle before accident, dotted line after accident.

This page was intentionally left blank.

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to $7,000 for each serious violation and for optional penalties of up to $7,000 for each nonserious violation. Penalties of up to $7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $70,000 for each such violation. A minimum penalty of $5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to $7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of $10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 562-2300
Boston, MA	(617) 565-9860
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 844-1600
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 975-4310
Seattle, WA	(206) 553-5930

Washington, DC
1997 (Reprinted)
OSHA 2203

Alexis M. Herman

Alexis M. Herman, Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration

This information will be made available to sensory impaired individuals upon request. Voice phone: (202) 219-8615; TDD message referral phone: 1-800-326-2577

This page was intentionally left blank.

This page was intentionally left blank.

DOCUMENT CONTROL INFORMATION: Document ID #CG001-Rev 10
SODA SPRINGS CONTRACTOR GUEST ES&H Guidelines 6.0 Site Requirements
APPROVER: KIRBY, MATT K - Contractor Safety Specialist
REVISION COMMENTS: Update procedure to current practices.

6.0 Contractor/Guest ES&H Site Guidelines

6.0 Table of Contents

Requirement Number	Title
6.1.0	Contractor Management Systems
6.1.1	Emergency Response
6.1.3	Training
6.1.4	English Proficiency
6.2.0	Working in an Operating Unit
6.2.1	Office Safety
6.3.0	Housekeeping
6.3.1	Basic Environmental, Safety and Health Rules
6.3.2	Personal Protective Equipment
6.3.5	Injury and Illness Recordkeeping and Reporting
6.3.7	Hand Tools
6.3.8	Scaffolding
6.3.9	Stairways and Ladders
6.3.10	Abrasive Blasting
6.3.11	High Pressure Water Blasting
6.3.12	Welding, Cutting and Brazing

6.0 Contractor/Guest ES&H Site Guidelines

6.0 Table of Contents

Requirement Number	Title
6.3.13	Slings, Chainfalls and Come-Alongs
6.3.14	Compressed Gas Cylinders
6.4.0	Fire Protection and Prevention
6.4.4	Monsanto Security Policy
6.5.1	Confined Space Entry
6.5.3	Lockout and Tagging
6.5.4	Electrical Safety
6.5.5	Hot Work Permit
6.5.7	Trenching and Excavation
6.5.9	Fall Protection
6.6.2	Hearing Conservation
6.6.3	Respirator Protection
6.6.4	Hazard Communication
6.6.5	Asbestos Abatement
6.6.7	Lead Exposure
6.6.8	Radiation Safety

6.0 Contractor/Guest ES&H Site Guidelines

6.0 Table of Contents

Requirement Number	Title
6.7.1	Cranes and Hoisting Equipment
6.7.3	Mobile/Powered Construction Equipment
6.8.0	Waste Management
6.9.1	Substance Detection

6.1.0 CONTRACTOR MANAGEMENT SYSTEMS

Contractors shall provide a full-time Safety Representative in the following conditions:

1. If they have 10 or more employees on site.

2. If they have less than 10 employees and the job has been defined as a high-hazard job through an ESH review, or required by the Contractor Safety Specialist.

   a.) The Full-time Safety Representative shall:

   - Have a minimum of three years experience in construction safety and have passed the OSHA 30 Hour Construction Course.

   - Must have Accident/Incident Investigation Skills.

   - In some incidences, First Aid/CPR certification.

   b.) The Safety Representative shall be responsible for all subcontractors, and to ensure they are following ESH requirements.

   c.) The Safety Representative's primary responsibility will be to continuously monitor the contractor's personnel, the contractor's subcontractor personnel and equipment to ensure compliance with all applicable ESH requirements.

   d.) If the Safety Representative does not demonstrate the ability to perform his/her work to the satisfaction of the Monsanto Representative, the Monsanto Representative may ask this person be replaced by another Safety Representative meeting the criteria listed above.

   e.) The Safety Representative must have the authority to correct any hazard or unsafe practice on the project, even if a work stoppage is required.

6.1.1 EMERGENCY RESPONSE

Purpose:

This plan provides for the immediate organization of all efforts to prevent injury to personnel, damage to property and the environment, and to ensure accountability of employees.

Scope:

The Plant Emergency Plan shall be used for any abnormal incidents that may occur inside of the Soda Springs Site including, but not limited to, personnel injury, or serious property or environmental releases, which have the potential to impact the surrounding community.

General:

Plant emergencies can be reported to PROVOX operators by dialing 777 on any plant telephone or by using plant radios.

The Plant Emergency Plan identifies two levels of plant emergencies:

> Level One – Emergencies controlled by the on-site emergency response team.
>
> Level Two – Any plant emergency that requires more resources than are available in the plant and/or environmental incident that would impact the surrounding area.

When upgraded to a level two incident, the furnace or kiln PROVOX Operator will be instructed to activate the plant emergency sirens initiating plant headcount procedures.

The emergency sirens are tested every Friday at 12:00 noon.

HEADCOUNT:

When the sirens are activated, Mark III will report to the Mark III Shop for headcount.

On weekends, holidays and night shifts, Mark III personnel assigned to manufacturing areas should report to the designated manufacturing headcount area.

Temporary contractors/visitors are to report directly to the guard station used for entry into the plant (East ext. 1310 or West ext. 1480) for headcount reporting.

NorthWest Cleaning personnel assigned to work in remote areas of the plant (Furnace Office, E&I Shop, etc.) should immediately phone East Security to report headcount and receive further instructions.

If the contractor/visitor cannot report to the assigned guard station, proceed to the closest designated area (listed below) and report by phone or radio to your assigned area (the guard station). The CMR assigned to the contractor/visitor is responsible to inform them of emergency procedures and, if possible, escort them to the assigned headcount.

Plant Headcount Areas

1. #8 & 9 Furnace Tapping Lunchroom
2. #7 & 8 Furnace Operating Level Lunchroom
3. Phos Dock Lunchroom
4. Main Shop Lunchroom
5. Machine Shop Lunchroom
6. Electric Shop Lunchroom
7. HEG Lunchroom
8. Department 10 Lunchroom
9. Mark III Shop Lunchroom
10. Security Office (East Entrance)
11. Security Office (West Entrance)
12. Admin. Building Multipurpose Room #59
13. Storeroom Conference Room

Evacuation:

In the event the evacuation becomes necessary, the emergency plan indicates two levels of evacuation:

Partial Evacuation – Instructions will be delivered via radio, telephone or runner.

Full Site Evacuation – The emergency sirens will be activated a second and third time, indicating the need for all personnel to proceed to the assigned evacuation collection areas as listed below:

Plant Evacuation Collection Areas

South Area: (as indicated by the assigned CMR)
Primary – Administration Building Multi-Purpose Conference Room.
Secondary – HEG Shop

North Area: (as indicated by the assigned CMR)
Primary – HEG Shop

Secondary – Administration Building Multi-Purpose Conference Room.

If you are outside of, or cannot safely reach, your designated collection area, proceed to the assigned secondary collection area and report by phone or radio.

The CMR assigned to the contractor/visitor if possible should escort them to the assigned evacuation collection area.

EMERGENCY EQUIPMENT:

1. The use of designated fire equipment for activities other than fire fighting is prohibited.

2. Know the location of, and how to use, emergency equipment in the area where you are working. Emergency equipment includes safety tubs, showers, eye wash stations, stretchers, positive air equipment and fire extinguishers.

3. Any contractor performing work on a fire protection system must first obtain an Impairment Permit from the Safety Department. Fire protection systems include fire water supply systems, sprinkler systems, FM-200 systems, etc.

4. Never block emergency equipment such as fire hydrants, hoses, extinguishers, emergency vehicles etc.

6.1.3 TRAINING

1. Contractors shall instruct each employee in the recognition and avoidance of unsafe conditions and regulations applicable to his/her work environment to control or eliminate any hazards or other exposure to illness or injury.

2. Contractors shall maintain records of all employee's training. Training records shall contain, as a minimum:

    a.) Name and signature of the employee

    b.) Date of training

    c.) Subject and content of the training

    d.) Means used to verify that employee understood the training.

    e.) Name of Instructor.

    f.) When requested, the Certified Monsanto Representative (CMR) shall be provided with documentation and certification of contractor training. In addition, the contract company must assure that all employees have the appropriate job skills, knowledge and proper technical certifications necessary to perform their work safely. Some certifications may include, but are not limited to: Certified Welders, Crane Operators, Qualified Electrical Workers, and Qualified Riggers. Monsanto reserves the right to audit Contractor Safety Training.

6.1.4 ENGLISH PROFICIENCY

1. All Contractors must have the ability to read and speak English in order to perform their work safely.

6.2.0 WORKING IN AN OPERATING UNIT

Department Hazards

1. No one shall enter another department to perform work or use that department's equipment without first obtaining permission from that department's Operating Crew Supervisor.

2. No unauthorized person should ever start up or shut down a piece of equipment in any department (unless danger to another person's life exists).

3. Never reach under or between belts, pulleys, idlers, rollers, chains, gears, etc., unless the equipment is locked out.

4. Equipment shall not be operated without proper guards and safety chains in place.

5. Only qualified members of the Monsanto Electrical Department will open electrical boxes to remove fuses, energize resets or to perform other electrical functions. Electrical contractors must first get clearance from the Monsanto Electrical Department to perform any electrical work. The use of Ground Fault Circuit Interrupters is required when using tools.

6. Due to the high potential of injury resulting from the uncontrollable whipping of an air hose, which has unexpectedly uncoupled, whip checks will be required when using tools such as jackhammers and air drills.

7. Whip checks are also required when doing any high-pressure water blasting. There are two types of whip checks available from the Plant Storeroom.

8. All snap-on hose connections must be secured by wire pins.

9. No one shall use compressed air to clean his or her clothing or body. Compressed air shall not be directed toward anyone.

10. Compressed air shall not be used for cleaning purposes except when reduced to less than 30 P.S.I., or when a venting device is used along with all appropriate personal protective safety equipment. Note: Use industrial vacuums whenever possible.

11. Department Supervisor's approval must be obtained before using steam or air to unstop a pipe or line.

12. When working with Soda Ash or Lime; goggles and dust mask or respirators with Hepa filters are required.

13. Any cam-lock fitting used on Soda Springs Sites must be secured with a secondary safety device such as wire ties, pins, etc., or other means to prevent inadvertent disconnection.

6.2.1 OFFICE SAFETY

The following items, while not intended to be all-inclusive, are indications of some of the areas of concern for good office safety:

1. Never carry pencils with points exposed in shirt pockets.
2. Report spills, slipping and tripping hazards to the supervisor immediately. Clean up or correct them as soon as possible.
3. Keep all machinery guards in place.
4. Never leave paper cutter arm in an up, or open position.
5. The following items, while not intended to be all-inclusive, are indications of some of the areas of concern for good office housekeeping:
6. Do not store used equipment in office.
7. Do not stack large amounts of paper, and other items, on the tops of file cabinets, bookcases and tables.
8. Clear desk and table tops at the end of each workday.
9. Use coat racks or closets for coats and surplus clothing.
10. Limit wall hangings to what is appropriate.

6.3.0 HOUSEKEEPING

1. It is each employee’s responsibility to keep his or her area clean and uncluttered.

2. Housekeeping will be performed on all jobs in a timely manner.

3. Every floor, working place and passageway shall be kept free from protruding nails, splinters, loose boards, water - creating slippery surfaces, and unnecessary holes and openings.

4. Containers shall be provided for collection and separation of all refuse. Covers shall be provided on containers used for flammable or harmful substances.

5. Extension cords and/or welding leads must be kept out of walkways and placed overhead whenever possible.

6.3.1 BASIC ENVIRONMENTAL, SAFETY & HEALTH RULES

Working safely is a condition of employment at this plant. Each employee (Monsanto & Contractor) must comply with the plant's safety rules and policies. Knowledge of these specific rules and policies is mandatory in order to perform work safely. In general, plant rules are provided to help insure everyone's safety. The following site-specific rules are provided to address specific safety concerns that are unique to our plant.

1. The best insurance against incidents and injuries:

   a.) Know the job, the pertinent safety rules and area hazards.

   b.) Keep focused and your mind on the work at hand.

   c.) Use common sense.

   d.) If you can't do it safely, don't do it.

   e.) If you don't know, don't be afraid to ask.

2. Only approved hard hats (ANSI 289.1-1969), which are equipped with goggles, shall be worn inside the plant.

3. Long hair below the nape of the neck must be pinned up or worn in a ponytail.

4. Radios, televisions, and cameras require permission from the Site Manager before being brought into the plant. The use of a cell phone camera for taking pictures requires permission from the Site Manager.

5. All individuals have a direct responsibility to immediately report unsafe acts or conditions to supervision. If a potential injury is imminent, an attempt must be made to stop the unsafe act or condition, and report it through the use of the corrective action form.

6. It is the responsibility of the CMR to explain area hazards to the contractor before the contractor performs any work.

7. All "Hot" work will cease if the plant disaster alarm is sounded. (This includes cigarette smoking)

8. Eating or drinking is prohibited in production areas (designated eating areas are provided).

9. Contractors must observe safety signs while on Monsanto property.

10. Contractors performing work inside the main office, service building, laboratory or storeroom, will wear the appropriate safety protection (to be identified by the Safety Department).

11. Always use handrails when going up and down stairs. Remember the 3-point contact.

12. Objects or equipment must never be placed within 3 feet of electrical boxes or disconnects.

13. Equipment shall not be operated within 15 feet of power lines.

14. A full-face cutting hood or a face shield with goggles is required when using a cutting torch.

15. A face shield with goggles is required when doing any kind of grinding, cutting, sanding, water blasting, sawing, hammering or chipping that might have the potential for flying debris.

16. BUTANE lighters <u>are not</u> allowed in the plant.

17. No one under the age of eighteen may work on Monsanto property. This includes contractors and sub-contractors.

18. Contractors should avoid strains when lifting by keeping their back as nearly upright as possible, using leg muscles instead of the back and stomach muscles. They should not attempt to lift more than 50 lbs per person without assistance.

PERSONAL CONDUCT:

Certain rules of personal conduct on the job are necessary for the successful operation of any organization. Some of the things that are prohibited while on Monsanto property are:

1. Smoking at Safety Meetings, in offices, or at any Monsanto function being conducted indoors.

2. Bringing intoxicating liquor or narcotics into the plant, or entering the plant under the influence of liquor or drugs, drinking or using narcotics on company property.

3. Bringing firearms or any type of explosive into the plant unless approved by the Site Manager.

4. Engaging in fights, horseplay, practical jokes or indecency.

5. Willfully damaging plant or personal property.

6. Using threatening or abusive language toward fellow employees or supervision.

7. Stealing.

8. Gambling on plant property.

9. Posting notices on company property without prior approval of Plant Management.

The above general rules cannot possibly cover all situations that might arise. As a rule of thumb, however, it can be assumed that contractors/visitors are not to engage in any activity that interferes with another employee's or group of employees work, or engage in activity that interferes with the normal continuity of plant operations or the maintenance of order on its premises.

JEWELRY POLICY:

1. Rings, metal band watches, bracelets and necklaces will not be worn in the plant, quarry, storeroom, lab or mine.

2. Rings, metal band watches, bracelets and necklaces will not be worn when performing maintenance/electrical work on plant property.

3. Hoop: earrings, nose-rings and brow-rings will not be worn in the plant, mine quarry, storeroom or lab or when performing maintenance/electrical work on plant property.

4. Stud jewelry is allowed.

5. Medical alert necklaces and bracelets are allowed and will be kept under clothing when performing maintenance.

BARRICADE TAPE POLICY:

All excavations, holes in floors, areas where work is being performed overhead, or temporary work areas where tripping or falling hazards exist will be covered over, roped off, or barricaded off. It is important that the proper barricade tape in conjunction with the proper tag be used when barricading an area. The Soda Springs Plant uses two types of barricade tape: yellow & black barricade tape and orange barricade tape.

All barricade tape must be tagged with either a DANGER tag or a CAUTION tag. The DANGER tag or the CAUTION tag must include a description of the hazard, be signed by the person establishing the barricade, be placed on the barricade tape and be spaced frequently enough for easy identification.

1. Orange barricade tape is to be used to barricade an area, which has been determined to be hazardous for entry. Orange barricade tape is considered the same as a lockout. Once the orange barricade tape has been put up, NO ONE IS ALLOWED TO ENTER THAT AREA, not even the person who applied the barricade tape. A DANGER tag must be attached to the barricade tape as described in #3 in this section. CAUTION tags are NOT to be used with orange barricade tape. Once the hazard has been identified and all safety precautions are taken to correct the hazard, the orange barricade tape can be taken down and replaced with yellow & black barricade tape (if necessary) so that work can proceed.

2. Yellow & black barricade tape is used to identify an area where a hazardous condition may exist. Either CAUTION or DANGER tags, as described in #3, may be used with yellow & black barricade tape.

3. When CAUTION tags are used, entry into the barricaded area may occur, after reading the warning on the CAUTION tag. If DANGER tags are used, entry into the barricaded area can only occur after requesting permission from the person who established the barricade. If work proceeds beyond shift change, the CAUTION or DANGER tags must be replaced and signed by the oncoming shift.

4. All barricade tape is to be promptly taken down when the reason for the barricade no longer exists. Barricade tape is to be placed in trash containers when it is removed. Barricade tape is NOT to be left lying on the ground in the work area.

5. All open holes in the floor must be surrounded by barricade tape.

PEDESTRIAN TRAFFIC:

1. Pedestrians must use designated walkways and be aware of the beeping signal from backing equipment. They should also be aware of the limited visibility of heavy equipment operators.

2. Stay a safe distance from a moving piece of equipment until the attention of the operator has been gained.

3. Running up or down stairways or throughout the plant unnecessarily is not allowed.

4. Do not sit on handrails or lean on safety chains.

5. Never enter pot carrier area, nodule stockpile area, or the belt filter press cake/ore screen house area, without proper clearance.

RAILROAD SAFETY:

1. Cross railroad tracts only at regular crossings provided for that purpose. If railroad cars are blocking a road or passageway, do not climb over, between, or under them instead, walk around them.

2. You should allow at least eight feet of clearance between you and the car. This rule is in effect at all times whether or not a switch is being made. Anyone violating this rule will be subject to disciplinary action.

3. No one shall place material, equipment or do work within 8 feet of the center line of any railroad track without first contacting the Material Handling Department and/or Phos Dock personnel to have the tracks Blue Flagged and Locked Out.

BLUE FLAG

a.) Whenever anyone is working around a railroad car at the phos dock, railroad shop, coke bunker(s), or anywhere on the plant tracks, a Blue Flag must be in place on the southernmost car on the affected tract.

b.) Keep derail closed at all times except when switching railroad cars.

c.) Chock the wheels on lead car on a downgrade.

d.) Any person(s) working in a railroad car area shall use a Blue Flag sign. Ownership and clearing of plant railroad tracks will be as follows:

- Heavy Equipment Group – Track 721, commonly known as track #1.
- Phos dock – Track 722, commonly known as phos loading track #2.
- Reliability group (Railroad Shop) – Track 723, 724, 728.

Note: Work by the (authorized) **owning track group** requires a Blue Flag only.

Note*:* Work by the (affected) **non-owning employees** requires the use of some type of control method in addition to the blue flag. For example, a tag lock and tag, or lockbox must be used by both the owning track group and non-owning employees. This will ensure that all involved groups are recognized and that communication is maintained.

e.) In the event that work is to be performed on a track by a group other than the owner, contact must first be made with the track owner and lockout tag affixed to the blue flag.

f.) Persons needing to work across or within eight feet of the phos loading track shall contact the phos dock Crew Supervisor or backup, and fulfill the following requirements.

1. The phos dock will place a tripod Blue Flag sign at the south end of the phos loading track. The phos dock and persons performing the work on or near the tracks must lock out the car puller if there are any cars to the north of where the work is to be performed.

2. Skates or chocks will be used on the first car on either side of the work area.

3. Non-phos dock person(s) performing the work will affix a lockout tag bearing his/her name to the Blue Flag tripod sign. This is necessary to move rail cars before the work is completed. If a lockbox is being used then a tag must be affixed to the blue flag indicating that a lockbox is being used.

4. Work should be completed as promptly as possible to minimize any impact on loading and switching activities. When work is complete and the tracks clear, notification should be made immediately to the phos dock. The lockout tag must be removed from the tripod sign and the car puller if locked should be unlocked.

5. In the event that work extends beyond the end of the phos dock personnel's shift, a special written permit will be issued by the phos dock to authorize removal of the Blue Flag. This permit will contain a checklist for the person removing the Blue Flag who may not be familiar with the procedure to assure that the track is cleared.

6. No one may remove a Blue Flag from the phosphorus-loading track other than the phos dock or the holder of a written permit.

7. No one shall remove a Blue Flag bearing a lockout tag.

WORK-IN PROGRESS/PERFORMANCE EVALUATIONS:

- Contractors must participate in work-in-progress audits when asked to by the Monsanto Representative.

WAPITI/BEHAVIORAL BASED SAFETY PROCESS:

- Contractors will be asked to participate in the BBS Process.
- The BBS process identifies behaviors, which may lead to an injury or property damage.
- BBS is part of the safety culture and is an important part of changing an unsafe act.

HAZARDOUS ENTRY AND GENERAL ENTRY PROCEDURES

A properly completed and approved hazardous work permit is required prior to performing hazardous jobs, entering vessels or entering designated confined spaces in the plant. The department Crew Supervisor may issue hazardous work permits or a responsible operator provided the conditions of the hazardous work permit can be met. Otherwise, the job must stop until the permit can be properly completed and approved or a special written clearance is obtained.

1. Hazardous work permits are only valid during the shift in which it was created. If the work proceeds past the end of the shift, a new hazardous work permit must be completed.

2. Hazardous work permits must remain at the job site until completed and then should be returned to the operating crew supervisor.

3. Only Monsanto Employees are authorized to start/stop equipment or open/close valves. When these steps are needed, contact your assigned CMR.

Note: Nitrogen and inert gas are used to purge oxygen from most vessels in the plant. Inert gas sometimes contains hazardous amounts of Carbon Monoxide. Breathing pure nitrogen or inert gas can be fatal.

Permits:

There are many different permits in this plant that have been developed to assist in performing safe operations. It is the responsibility of each individual to know when and where a permit is required to perform a job. If in doubt about the need for or use of a permit, ask the CMR who represents you. Listed below are some of the permits that are used at this site. This list is not all-inclusive, other permits may be necessary and your assigned CMR will assist you in determining permits you need to complete your assigned work:

1. Hot Work Permit
2. Work Execution Permit
3. Confine Space Entry Permit
4. Line Entry Permit
5. Lifting Personnel with Crane Permit
6. Elevated Work Permit
7. Excavation Permit

6.3.2 PERSONAL PROTECTIVE EQUIPMENT

1. Safety glasses with side shields are required gate to gate, except in offices or control rooms. Each contractor/visitor must have goggles attached to their hard hat at all times.

2. Each contractor/visitor will be required to wear a hard hat, long sleeved shirt, and hard toed shoes. A pair of leather gloves is also recommended.

3. Earplugs are to be worn in any areas identified as high noise areas.

4. Any contractor who has had a tooth pulled or any type of dental work, which has caused an opening to the jaw within the last six weeks, must have dental clearance to work in the Furnace or Phos Dock areas.

5. Women of childbearing potential are not permitted to work in the Furnace Building during shutdown activities without the use of an Air-purifying Respirator equipped with Acid Gas cartridges. The cartridges must be changed after every four hours of use or at the end or each shift.

6. Contractors working near radioactive sources such as belt scales or density meters should notify the Radiation Safety Officer (Dave Matyus/Senior IH ext. 1313).

7. PPE requirements for personnel working on energized electrical lines is listed in 6.0 document 6.5.4 Electrical Safety.

OTHER PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS:

All contractor’s personnel will be required to wear Kevlar (cut resistant) gloves when engaged in the handling of sharp edged materials or when involved in cutting operations with hand tools where there is a potential for common hand/arm injuries such as cuts, scrapes, burns, etc.

Kevlar (cut resistant) gloves are required when handling utility knives, pocketknives, and any other tool involving cutting operations where there is a potential for hand injuries such as cuts, scrapes, burns etc.

Kevlar (cut resistant) gloves are required when engaged in any activity involving sharp edged materials such as sheet metal, fabricated steel units, insulation with metal coverings, etc.; wherever there is a potential for arm injuries such as cuts, scrapes, burns, etc., or when handling utility knives and/or pocketknives.

6.3.5 INJURY AND ILLNESS RECORDKEEPING AND REPORTING

The Plant Dispensary is available for initial treatment of injuries which occur on company property. The plant has a trained 24 Hour Emergency Response Team and EMT's for rescue work. Call 777 for emergency first aid support. Be sure to give your name, the location of the injured, and if possible, the extent of the injury. Go or send someone to direct the emergency crew to the exact location of the injury.

1. Contractors/visitors are required to immediately report all injuries, no matter how small, to the CMR and Safety Department or on-shift EMT. A First Aid card (blue/Contractors) must be filled out immediately for any first-aid or injury. Any transport to the hospital requires a blue first aid card to accompany the injured/ill employee. MD information is required on the back of the card. The first aid cards are located in the Administration Building Dispensary. The CAF (corrective action form) is attached and must also be submitted.

2. Contractors are required to submit a monthly Man-Hour & Illness/Injury Report to the Contractor Safety Specialist.

6.3.7 HAND TOOLS

1. Contractor's tools shall be of good industrial grade.

2. Materials or tools shall not be dropped or thrown from platforms, structures or scaffolds.

3. No one is permitted to carry pipe, tapping bars, or other long objects on his/her shoulders through doors, past blind corners or up steps, except when there are persons located at each end of the object being carried.

4. Each contractor shall, at all times, maintain good housekeeping standards; an integral part of his/her work.

5. Containers five gallons or less used to store and/or dispense flammable or combustible liquids require the following: Only an UL approved metal container with a spring closing lid, a flash-arresting screen, and spout cover designed to safely relieve internal pressure.

6. Using a splice called the "Hasty Eye or Molly Hogan" on a wire cable is strictly prohibited. This splice is limited to about 70 percent of the strength of the wire rope. This method of splicing is used to create a loop in the wire rope. The cable is split and the ends are wrapped back around and woven into the cable.

7. All electric power tools must be double insulated or equipped with a three-pronged plug and inspected annually.

8. Portable machinery and power tools must have a spring loaded power switch installed which allows the tool to automatically cut off when not in use.

9. If working in potentially explosive atmospheres, use only approved tools for that type of work.

10. Employers shall not issue or permit the use of unsafe hand tools, including tools that may be furnished by employees or employers.

11. All hand tools must be properly maintained.

12. The wooden handles of tools shall be kept free from splinters or cracks and shall be kept tight in the tool.

13. Impact tools shall be kept free of mushroomed heads.

14. You should wear cut resistant gloves when handling knives and other sharp objects.

15. Contractor knives must meet or exceed the design of Soda Springs Site approved knives listed below. For example, the Stanley auto-retractable performs like the Martor and may be used. General locking blades should have the same design characteristics that the Klein has (locking mechanism on the spine) not at the hinge where material gathers and obstructs the locking mechanism.

16. The following 4 locking knives are approved for general use without supervisory approval:

    - 10306229 – Klein Locking – Small
    - 10306230 – Klein Locking – Medium
    - 10306231 – Klein Locking – Large
    - 10401303 – Bucklite folding lock blade w/clip (3”)

17. The following 3 knives are approved for specialized use with supervisory approval:

    - 07152 – Martor utility auto-retracting straight pointed tip. Uses include: mailroom, storeroom & cutting drywall)
    - 04152 – Martor utility auto-retracting hooked tip. (Uses include: electrical wire insulation removal)
    - 10407370 – Klein Locking Electricians (2.5”) – (for specialized electrician use only)

18. Food preparation knife use is not covered by this policy and may occur anywhere it is designated (sanitary) to do so.

19. Personal knives need to be left in lockers or for contractors in vehicles.

20. Belting knives (special use) will be approved by the CMR.

21. Insulator’s fixed blade knives must be approved by the CMR.

22. Letter openers that have a fixed blade and are shaped like knives are approved.

NOTE: Always ensure that you use the proper tool for the job. (i.e. snips, shears, wire cutters. Retractable blade utility knives, scissors, etc.

Angle Cutter Usage

Angle grinders used for anything other than grinding are subject to the Automatic Torque Limiting Clutch Requirements.

Common PPE Requirements :

- Hard hat (when working in the field)
- Goggles or TFFG (tight fitting foam glasses)
- Full face shield
- All leather gloves
- Hearing protection
- All leather steel toe boots
- Loose fitting clothes should be tucked in and secured
- Dust mask required in high dust producing area
- Spats
- Kevlar sleeves/arm protection (to elbow)
- Leather welding jacket or apron (for chest and stomach protection)
- Kevlar neck protection
- Minimum 6’’ cuff height on boots

Usage Requirements :

- **Use only cutters equipped with Automatic Torque Limiting Clutch for protection against kickback (Ex. Dewalt model #D28144N)**
- Cutting attachments should be used when possible
- Always use handle when cutting ; keep both hands on tool and maintain good footing and balance
- Use the right discs for the right machine (RPM rating, Usage, Size, etc.) with metal inner support
- Insure condition and proper installation of disc. Inspect for cracks, uneven wear, and overall condition
- Avoid cross-contamination by not using the same discs on different metals
- Properly secure the items being cut
- Double button pushed in right sequence on bigger machines (9’’ and above)
- Must stop automatically (braking system) when button is released on bigger machines (9’’ and above)

- **Never use grinding disc for cutting**
- **Never use cutting wheels for grinding**
- **Never use tools with triger locks**

*****These are guidelines for the use of this tool – any variance requires management exception*****

6.3.8 SCAFFOLDING

Scaffolds and staging must be used in a manner consistent with the Monsanto Policies. Scaffolds and staging must be inspected and receive approval prior to use. Your assigned CMR will make arrangements for qualified scaffolding inspection. All contractors encountering, in their opinion, unsafe conditions have the responsibility to stop elevated work and lock out scaffolding and staging until the unsafe conditions are resolved.

1. Scaffold and/or staging must be made of suitable selected planks and must be securely tied or fastened in place before they are used.

2. Scaffold and/or staging must **not** be left at the job site after the job has been completed.

3. No scaffold or staging shall be erected or used without the Department Crew Supervisor approval.

4. All persons working on scaffolding over four feet without use of adequate hand/guardrail will be required to use fall protection.

5. Scaffolding will not be left up for more than 30 days between jobs.

6. No scaffolding will be used unless approved by a competent person using the Scaffolding Procedure and the Scaffolding Hazardous Work Permit.

6.3.9 STAIRWAYS AND LADDERS

1. Always inspect ladders before using them, as outlined in the Plant Ladder Inspection Procedure.

2. Immediately remove defective ladders from service.

3. A safety harness is required if it is necessary to perform work from a ladder at heights at or above four feet in elevation. If a safety harness is not possible to wear, a fall protection plan must be completed and, if necessary, signed by a safety representative and area leader.

4. Only one person at a time is allowed on a ladder.

5. Do not “jump” or “outreach” any ladder. If a ladder cannot be tied off, a second person must support the ladder.

6. The angle which a ladder is placed should be as follows: The base of the ladder is placed one-fourth the length of the ladder from the object against which it is leaning.

7. The top of a ladder must extend no less than three feet above the supporting object when used for access to an elevated work area.

8. After a ladder’s extension section has been raised to the desired height, the safety togs or latches shall be engaged and the extension rope secured to a ring on the base section of the ladder before use.

9. Extension ladder sections shall not be used separately.

10. Stepladders shall be positioned with all four feet in contact with a firm, level surface. Stepladder spreaders shall be locked in place.

11. Do not use a stepladder as a straight ladder.

12. Don't climb higher than the third rung from the top on straight, extension or step ladders. **NOTE:** The top-most platform, or rung, is rung #1.

13. Ladders shall be tied off when used close to the edge of an elevated platform, roof or floor opening.

6.3.10 ABRASIVE BLASTING

1. A respirator is required that is constructed so it covers the wearer's head, neck, and shoulders to protect the wearer from rebound abrasive.

2. Operators shall be equipped with heavy canvas or leather gloves and aprons, or equivalent protection, to protect them from the impact of abrasives.

3. The Environmental Department must be notified before abrasive blasting is conducted. Insure that your CMR has contacted the Environmental Department.

4. Dust shall not be allowed to accumulate on the floor or ledges outside of an abrasive-blasting enclosure, and dust spills shall be cleaned up promptly. Aisles and walkways must be kept clear of steel shot or similar abrasive, which may create a slipping hazard.

6.3.11 HIGH PRESSURE WATER BLASTING

1. A hazardous work permit is required to be filled out prior to work. Your assigned CMR will provide you with this information.

2. The following specific PPE is required for this type of work:

   a.) Water Armor (turtle skin)

   b.) Full slicker suit (Aluminized Clothing in Phosphorus applications)

   c.) Face Shield

   d.) Rubber gloves or Kevlar rubber coated gloves

   e.) Leather Spats

   f.) Hearing Protection

3. Whip checks are required and must be used at all times.

4. Ten-foot area surrounding pressurized hose must be barricaded or hose contained within a shielded device. (If hose is not shielded, anyone inside the 10 foot barricade will be required to use the PPE listed in Step 2 of this procedure.)

5. All foot valves must require double action to activate or be shielded in such a way as to prevent inadvertent operation.

6. Shotgun triggers must include a safety lock or be the dual hand design.

7. Shotgun lance must be a minimum of at least 36 inches. Exceptions to this policy require approval from your CMR, Safety Department and Area Supervisor.

8. Water blasting equipment must be operated by at least two trained operators. Pump operator must remain within 25 feet of pump when in operation.

9. All operators must have in their possession a Medical Emergency Card. This card must contain information relating to treatment of potential injuries from water blasting activities.

10. Pump must be disengaged before mole is either inserted or removed from pipe.

6.3.12 WELDING, CUTTING & BRAZING

1. Employers shall instruct employees in the safe use of welding equipment.

2. Proper precautions (isolating, welding and cutting, removing fire hazards from the vicinity, providing a fire watch) for fire prevention shall be taken in areas where welding or other “hot work” is being done.

3. A hot work permit must be filled out and kept at the work area.

4. Defective cables shall be replaced or repaired.

5. The proper PPE must be worn while performing hot work (see your assigned CMR or safety department for specifics).

Hot Work Personal Protective Equipment Requirements:

General Hot Work:

1. Head/Neck Protection:

    a.) Full Face Shield

    b.) Welding: Lens shade 10-14

    c.) Cutting: Lens shade 3-6

2. Upper Torso and Arm Protection (no pockets above the waist):

    a.) Full fire retardant coat, leather, Banware (brown), w/leather sleeves, silver gear, or Kevlar coveralls/jacket

    b.) Kevlar wrist sleeves

3. Hand Protection:

    a.) Full leather gloves with leather or fire retardant canvas gauntlet (air arcing requires welding gloves)

4. Foot Protection:

    a.) All leather boots with a minimum 6” cuff height (no exposed poly/nylon portions

    b.) Spats (worn underneath pants, coveralls, overalls etc.)

5. Respiratory Protection. Consider the following options when selecting respiratory protection:

   a.) Exhaust fan

   b.) Fume collectors

   c.) Blower fans

   d.) 3M Hood

   d.) Respirators

   f.) 3M Hood should be worn when air arcing and plasma cutting

6. Hearing Protection:

   a.) Ear plugs or muffs

Hot Work Limited to Grinding and Gas Shielded Welding:

1. Head/Neck Protection:

   a.) Full Face Shield

   b.) Welding: Lens shade 10-14

2. Upper Torso and Arm Protection:

   a.) Kevlar Sleeves to Elbow

3. Hand Protection:

   a.) All Leather Gloves

4. Foot Protection:

   a.) All leather boots with a minimum 6” cuff height (no exposed poly/nylon portions)

   b.) Spats (worn underneath pants, coveralls, overalls, etc.)

5. Respiratory Protection. Consider the following options when selecting respiratory protection:

    a.) Exhaust fans

    b.) Fume collectors

    c.) Blower fans

    d.) 3M Hood

    e.) Respirators

6. Hearing Protection:

    a.) Ear plugs or muffs

Confined Space / Overhead Hot Work:

1. Head/Neck Protection:

    a.) 3M L-905 full head protection (Kevlar hood with full face shield may be substituted with supervisor approval. JSA must be signed by supervisor or designee for exception to apply).

    b.) Light sensitive lens, or adequate shade protection

2. Total Body Protection:

    a.) Any combination of Kevlar, leather, or silver gear that provides full body protection (no pockets above the waist)

    b.) Kevlar wrist sleeves

    Safety Point: Consideration of potential heat stress must be evaluated and appropriate PPE worn. (i.e. pot repair requires aluminized chaps, coat and leggings, which provides better air circulation around welder)

    Safety Point: Hot work conducted within confined spaces will require continuous atmospheric monitoring to ensure that workers are protected against the potential for oxygen depletion.

3. Hand Protection:

   a.) Full-leather gloves with leather or fire retardant canvas gauntlet (air arcing requires welding gloves)

4. Foot Protection:

   a.) All leather boots with a minimum 6" cuff height (no exposed poly/nylon portions)

   b.) Spats (worn underneath pants, coveralls, overalls, etc.)

5. Respiratory Protection:

   a.) 3M L-905 full head protection (respiratory protection may be provided using items listed in General Hot Work section with supervisor approval. Supervisor or designee must sign JSA when substituting for 3M Hood)

6. Hearing Protection:

   a.) Ear plugs

6.3.13 SLINGS, CHAINFALLS & COME-ALONGS

- Use softeners to protect slings from sharp edges.
- Visually inspect all rigging before and after use.
- Remove defective items to be repaired with a tag or destroy it immediately.
- Decide on acceptable rigging with the use of a pre-job risk analysis prior to rigging.
- Always use a tagline when using overhead rigging unless the tagline will create an entanglement hazard.
- Do not leave an unsecured and unattended load from hanging on a crane, hoist or chain-fall.
- Any lift over five ton or in a hazardous area (over piping) will be required to use the plants Critical Lift Plan and must be filled out prior to lifting.

MONSANTO

Crane Lift Plan

This work instruction checklist is required for all lifts exceeding **(5)tons.**

Location ______________ Date of lift ______________
Load Description ______________
Lift Description ______________

A. **Weight:**

1. Equipment Condition New ☐ Used ☐
2. Weight empty ______lbs
3. Weight of headache ball ______lbs
4. Weight of block ______lbs
5. Weight of lifting bar ______lbs
6. Weight of slings and shackles ______lbs
7. Weight of jib ______lbs
8. Weight of headache ball on jib ______lbs
9. Weight of cable (load fall) ______lbs
10. Allowance for unaccounted material in equipment ______lbs
11. OTHER______________ ______lbs

TOTAL WEIGHT ______lbs

Source of Load Weight ______________
name plate, drawings, calculated, etc.

Weights verified by: (name) ______________

B. **Jib:**
Erect______________ Stored______________
1. Is the jib to be used? ______________
2. Length of jib______________
3. Angle of jib______________
4. Rated capacity of jib______________

C. **Crane Placement:**
1. Any deviation from a smooth solid foundation in the area? ______________
2. Electrical hazards in the area? ______________
3. Obstacles or obstructions to lift or swing?______________
4. Swing direction and degree (boom swing)______________

D. **Cable:**
1. Number of parts of cable______________
2. Size of cable ______________

Crane inspected by:______________
Functional test of crane by:______________
Designated Groundman:______________
Wind conditions at time of lift______________

E. **Sizing of slings**

1. Sling selection
   a. Type of arrangement ______________
   b. Number of slings in hookup ______________
   c. Sling length ______________
   d. Rated capacity of sling ______________
2. Shackle selection
   a. Capacity ______________
   b. Shackle attached to load by: (name) ______________
   c. Number of shackles ______________

F. **Crane**

1. Type of crane ______________
2. Crane capacity ______________
3. Lifting arrangement
   a. Max. distance - Center of load to center pin of crane
   b. Length of boom ______________
   c. Angle of boom at pickup ______________degrees
   d. Angle of boom at set ______________degrees
   e. Rated capacity of crane under most severe lifting conditions (from chart)
      1. Over rear ______________lbs
      2. Over front ______________lbs
      3. Over side ______________lbs
      4. From chart - rated capacity of crane for this lift ______________lbs
      5. Maximum load on crane ______________lbs
      6. Lift is what percentage of crane's rated capacity ______________%

G. **Pre-lift Checklist**

1.	Matting acceptable	Yes	No
2.	Outriggers fully extended	Yes	No
3.	Crane in good condition	Yes	No
4.	Swing Room	Yes	No
5.	Head room check	Yes	No
6.	Maximum counterweights used	Yes	No
7.	Tag line used	Yes	No
8.	Experienced operator	Yes	No
9.	Experienced groundman	Yes	No
10.	Experienced rigger	Yes	No
11.	Radios used	Yes	No
12.	Anti-two block device used	Yes	No

Note: If radios are used they must be dedicated crane radios.

Special instructions or restrictions for crane, rigging, lift etc. ______________

Diagram crane an load placement	Diagram rigging configuration

Multiple crane lifts require a separate lift plan for each crane.

Any change in the configuration of the, placement, rigging, lifting scheme, etc. or changes in any calculations require that a new lift plan be developed.

When lifting personnel with a crane obtain the Hazardous work permit titled: Lifting Personnel with Cranes

Signatures:

Project Leader / Planner ________________________________

Crane Operator ________________________________

6.3.14 COMPRESSED GAS CYLINDERS

1. Keep compressed gas cylinders away from radiators and other sources of heat.

2. Store compressed gas cylinders in designated areas.

3. Compressed gas cylinders need to be secured in an upright position to prevent falling, or improper settling within the cylinders.

4. Oxygen and acetylene cylinders are required to have a ½ hour rated fire-wall (quarter inch plate) barrier between the bottles or be twenty feet apart.

5. Never move cylinders with regulators attached.

6. When gas cylinders are transported, moved or stored, valve protector caps must be place.

6.4.0 FIRE PROTECTION AND PREVENTION

1. Fire extinguishers shall be provided and located within 100 feet from any work location.

2. A fire extinguisher must be provided in each vehicle.

3. Fire extinguishers must be inspected monthly and annually.

4. A Fire Impairment Permit is required to be used when any fire suppression systems are temporarily going to be impaired.

5. All employees must be trained in the proper use of fire extinguishers if they are required to use one.

6. Fire watch designee must be properly trained and competent.

7. There must be a hot work permit filled out prior to any hot work if combustibles are present. If there are any questions please call Safety Department.

8. All tanks, drums, and vehicles need to be grounded or bonded (to one another) when transferring flammable/combustible liquids.

6.4.4 MONSANTO SECURITY POLICY

1. Contractors and their employees normally will be governed by the terms of their particular contract. In all cases, contractor's personnel are confined to the area in which they are working.

2. Contractors and their employees will use the entrance and exit gate, which has been designated by Monsanto.

3. Service Representatives and Service Company employees who are not under a formal contractual arrangement will be registered in and out. The plant guards will administer the above policy and enforce the necessary rules required to carry it out.

4. Contractor parking facilities will be separate from Monsanto Employee parking.

5. An approved Material Pass will be required for contract employees and visitors when leaving company property with bundles, packages, boxes, materials, equipment, etc. Plant guards may periodically inspect packages even though the individual may have a Material Pass. Lunch boxes do not require a pass, but must be opened for inspection upon request. Vehicles leaving the plant are also subject to inspection at any time.

6. Each contractor's employees and/or visitors will be required to identify him or herself when entering or leaving company property. This shall include signing the log in the guard station.

7. Only the Plant Manager or their delegate can authorize the use of cameras, camera equipment or cell phone cameras. They will not be permitted within the plant without this authorization. Any photographs or video taken of the facilities will need the same authorization.

6.5.1 CONFINED SPACE ENTRY

1. A confined space permit must be filled out before entering into any vessel or designated confined space area.

2. No entry will be made until proper clearance has been received.

3. No entry will be made with less than two people.

4. All lockouts made in connection with the entry will be made by the person or persons entering the enclosure.

5. A confined space retrieval system (tripod or other suitable means) will be used if hazards are identified on the work permit or if conditions in the confined space may have changed.

6. Atmospheric testing must be done before, during, and after any entry.

7. The entry team and effect employees must review the confined space procedure prior to any entry to ensure full comprehension of the procedures.

8. A trained confined space attendant must be present at all times when the confined space is occupied. Contact your CMR if there are any questions or clarifications needed prior to entry.

6.5.3 LOCKOUT AND TAGGING

Purpose:

This procedure establishes the minimum requirements for the lockout or tagout of energy isolating devices. It shall be used in conjunction with other safety procedures (vessel entry, confined space entry, etc.). It shall be used to ensure that machinery or equipment is isolated from all sources of potentially hazardous energy and locked out, or tagged out before employees perform servicing or maintenance activities where the unexpected start-up, or release of stored energy could cause injury.

This procedure is designed to comply with the requirements of 29 CFR 1910.147 (Lockout/Tagout), and the program requirements or paragraph 29 CFR 1910.333 (b), Electrical Safety Related Work Practices.

Scope:

The primary focus of this procedure is to ensure that each person involved in the servicing, or maintenance of machinery or equipment will be protected from all forms of potentially hazardous energy by a lock or tagout tag which that person controls. All portions of this procedure are intended to accomplish this goal.

1. Training shall be provided to ensure that employees understand the purpose and function of the energy control programs and that the knowledge and skills required for the safe application, employees acquire usage and removal of energy controls.

2. Contractor employees shall receive training equivalent to that required for location personnel performing similar tasks.

3. Documentation of training is kept in the Safety Department on all employees that are affected by the Lockout/Tagout Procedure.

6.5.4 ELECTRICAL SAFETY

1. Employers must provide either ground-fault circuit interrupters (GFCIs) or assured equipment grounding conductor program to protect employees from ground-fault hazards at construction sites.

2. Cords must not suspend temporary lights, unless they are so designed.

3. Lights for illumination must be protected from breakage, and metal shell sockets must be grounded.

4. Worn or frayed electric cords or cables shall not be used.

5. Keep extension cords out of water, mud and at least seven feet above walkways.

6. Workspaces, walkways, and similar locations shall be kept clear of cords.

7. Ensure that all mobile equipment is at least 15 feet from overhead power lines.

8. Barriers or other means of guarding must be used to ensure that workspace for electrical equipment will not be used as a passageway during periods when energized parts of equipment are exposed.

9. Contractor shall comply with Soda Springs Plant Electrical Site Work Practices.

Energized Electrical Work Procedure:

Any work performed on electrical equipment should be completed with the equipment in a non-energized, electrically safe condition. However, it is recognized there may be instances where this is either not possible or not feasible. Connecting or disconnecting an energized electrical conductor carrying more than 50 volts requires an Energized Electrical Work permit (See example appendix A) Contractors which elect under the direction of the CMR to perform this type of work shall utilize the Energized Electrical Work Permit to address the following requirements:

- Authorization to perform this work shall be granted by a member(s) of site management,
- Appropriate PPE shall be utilized to prevent electric shock as well as serious injury should an arc flash occur, and
- A “standby individual” shall monitor the activities of the individual working on the energized circuit. This individual must be able to quickly summon assistance if needed.

- Testing a circuit to troubleshoot or confirm it is de-energized does not require an Energized Electrical Work Permit.

Whenever work is performed on or near a 50-volt (or higher) circuit which has not been confirmed to be de-energized, the following PPE shall be worn:

- Insulating gloves, and, tools/test instruments are required if circuit is 300 volts or higher.
- Safety glasses
- Hard Hat

PPE Requirements for Arc Flash

Where there is risk of an arc flash, personal protective equipment (PPE) shall be worn to prevent injury. The appropriate PPE shall be selected by using the arc flash hazard rating label attached to the specific equipment being worked on. If label is not present, PPE may be selected using the criteria shown in Appendix B, The current edition of NFPA 70E, Standard for Electrical Safety in the Workplace, contains additional information on electrical safe work practices, arc flash hazards, and personal protection equipment.
Within Monsanto, the probability of a hazardous arc flash with circuits of 240 volts (or less) supplied from a 125 kVA (or less) transformer is viewed to be minimal. Thus, work on these systems carries no arc flash PPE requirements.

APPENDIX A - Energized Electrical Work Permit Example

Area/Location: ____
Date: __________________________
Energized voltage present: ______________________________________
Brief description of work to be done:_______________________________
____
____
____
Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage:_______________________
____
____

What PPE will be utilized:
Insulating mat _____________ Insulating gloves ___________________
Insulated tools _____________ Safety glasses ____________________
Flame-resistant clothing Rating___________________________________
Arc flash suit ____________________ Other ____________________

Electrically Qualified Person______________________Date:____________
Electrically Qualified Person _____________________Date: ___________
Emergency communication established:
Phone ___________ Radio ___________ Other ____________

Approval:
E&I Crew Supervisor or
Elect. Qualified Project Engineer_________________ Date: _______
Area OCC___________________________________ Date: _______

APPENDIX B - PPE EXAMPLE

NOTE: The voltages shown are the maximum voltage between any two conductors.

Energized system voltage ….	**PPE which should be selected ….**
50 – 300 volts	Individuals working near exposed live, or not confirmed to be de-energized, electrical circuits shall utilize insulated tools or gloves rated for the maximum voltages to which they could be exposed. Additionally, safety glasses and a hard hat are worn.
300 – 600 volts	Individuals working near exposed live, or not confirmed to be de-energized, electrical circuits shall utilize insulated tools and gloves rated for the maximum voltages to which they could be exposed. Additionally, safety glasses, hard hat and an arc-rated face shield/flame retardant clothing (e.g. flame retardant coveralls worn over normal work clothing) with a minimum rating of 8 cal/cm^2 must be worn.
600+ volts	The requirements for work near exposed live, or not confirmed to be de-energized, electrical systems with more than 600 volts is not covered in this document. The hazards associated with these systems are complex and considerable experience is required to perform this work safely. Thus, great care is needed whenever work is performed on these systems and qualified personnel are essential for any type of work activity.

6.5.5 HOT WORK PERMIT

1. Prior to performing Hot Work your CMR will provide you with an Execution Work Permit/Envelope.

   a.) Using the work execution envelope you can determine if a hot work permit will be needed.

2. Anytime a hot work permit is issued at a minimum, a routine fire watch is required.

3. Cylinders should never be taken inside tanks or vessels in which work is being done.

4. Empty cylinders or drums must not be used as a workbench for cutting or welding.

5. Do not ground machines to handrails, stairs or projections from control rooms, etc. or on any active process line, motor or conduit.

6. Portable welders must not be moved until the power is shut off.

7. Before starting any Hot Work, complete a Hot Work Permit with the equipment operator or your assigned CMR.

6.5.7 TRENCHING AND EXCAVATION

1. Before any excavation, trenching, or digging of any depth is performed, an Excavation Permit (yellow) must be filled out. Contact your CMR, who will obtain an execution permit for you. Appropriate personnel must sign the Excavation permit before work is executed. Your CMR will work with you to ensure underground lines are identified and marked.

2. Every employee involved in excavation work must read and understand the "Procedure for Construction or Normal Plant Excavation Work" document. Your assigned CMR will assist you with this document.

6.5.9 FALL PROTECTION

Elevated Work Permits:

Any contractor performing work at a height of four feet or more above ground and not protected by a handrail, mid-rail, and toe board is required to wear personal fall protective equipment consisting of a Body Harness with one of the following:

1. Six foot lanyard with shock absorber
2. Double lanyard with shock absorber
3. Self-retracting lanyard (connected directly to harness)

Fall Protection Policy:

1. No climbing allowed on tractor-trailer trucks if above the four-foot limit.
2. When it becomes necessary to perform elevated work on railcars or trucks in the field, away from fall protection systems, a Pre-Job Risk Analysis as well as a fall protection permit must be completed and a member of the safety department must approve fall protection measures.
3. Use of the proper fall protection/arrest system is required when performing elevated work. Systems include but are not limited to:
    - Static Lines
    - Secure tie-off points
    - Guardrail(s)
    - Platform(s)
    - Control Line(s)
    - Safety Monitor
4. Based on the potential for severe injury and death due to a fall, we require the proper use of a fall protection/arrest system. Failure to use a correct fall protections/arrest system will be regarded as a willful disregard of safety requirements. Contractor will be removed from Monsanto property.

5. When working over or near walking or working surfaces where a drop of greater than four foot is present; fall protection is required.

6. For better clarification contact your CMR.

MAN BASKET SAFETY:

The plant procedure for lifting personnel in a man basket must be followed. This procedure includes a test lift and a pre lift meeting with affected personnel. Personnel may only be lifted with a crane equipped with an anti Two-Block system.

A Critical Lift Permit shall be obtained and filled out prior to lifting personnel in a man basket and only a designated (OSHA approved) man basket shall be used. (100% tie off still required)

6.6.2 HEARING CONSERVATION

1. All areas above 85dBA will be posted with "Hearing Protection Required" signs. Employees in these areas must wear hearing protection.

2. Employees shall be trained annually on the contents of the Hearing Conservation Program.

3. Exposure to impulsive or high impact noise shall not exceed 140dBA-peak sound pressure level.

4. If a concern exists about noise levels, contact your CMR, who can arrange a test for the sound levels in the work area.

5. Job tasks which exceed 100dBA TWA, regardless of shift length, require double hearing protection (muffs and plugs).

6.6.3 RESPIRATOR PROTECTION

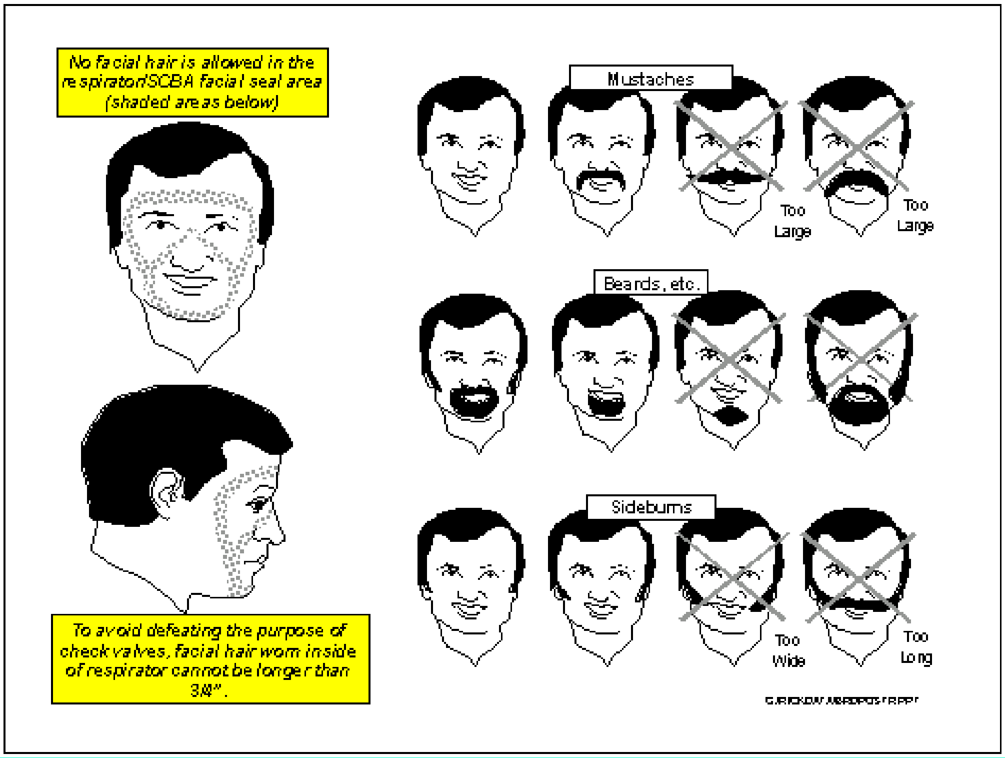
Any occurrence of chemical exposure must be immediately reported to the Safety Department.

Respiratory Protection is required for work performed in Plant Specific areas and for various job tasks. All persons entering the Furnace/Phos dock areas must have a respirator with acid/gas cartridges on their person and readily available. Contractors must comply with OSHA's respiratory protection rule 1910.34, which includes, but is not limited to:

- Written Program
- Employee Training
- Medical Evaluation
- Fit-Testing
- Cleaning, Storing, Maintenance of Respirator
- Facial hair in sealing surface
- Breathing air quality

Visitors/Contractors to the Plant who are not required to remain in respirator-use areas may be given an escape respirator to access respirator areas.

All visitors/contractors entering the plant will follow the plant beard policy. This policy states that the seal area of the respirator must be clean-shaven so that facial hair does not interfere with the seal of a respirator.



Contractors/visitors will know and understand the hazards of the following when entering affected areas:

Carbon Monoxide (CO)=Measure chemical with CO Monitor. A supplied air respirator is the only type of protection, which works for CO. Explosive limit 12.5-74.2%. 8 hour TWA 25ppm. An employee shall not be in any CO area with concentrations from 25-99 ppm for more than 1 hour without wearing supplied air. Health Effects: headache, Nausea, Dizziness, Cherry red face, Confusion, Unconsciousness. Characteristics: Colorless, odorless, tasteless gas with no warning signs.

Phosphine (PH3)=Measure chemical with Phosphine monitor. A supplied air respirator is the only type of protection, which works for PH3. Explosive limit unknown. Health Effects: Coughing, Breathing Difficulties, nausea, diarrhea, chills, tightness of the chest, may have delay effects 12 to 24 hours after exposure. Characteristics: Fishy/Garlic-like odor.

Phosphorus (P4)=Wear an acid gas cartridge with respirator upon combustion. Characteristics: Will burn instantly with air contact, yellowish to white in color. Can be in the form of a liquid, solid or gas. Suspect P4 to be present when opening any valve or equipment connected with the furnace, phos dock, CO main, waste water lines, or recycle lines. If P4 has contacted your skin or clothing immediately submerge in water. There are safety tubs located throughout the plant.

Hydrogen Sulfide (H2S)=Measure chemical with a H2S Monitor. Eight hour TWA 10ppm. Explosive limits 4.3-46%. A supplied air respirator is the only type of protection, which works for H2S. Health Effects: Headache, dizziness, upset stomach, unconsciousness. Characteristics: Rotten egg smell, may deaden sense of smell over time.

Sulphur Dioxide (SO2)=Measure chemical with SO2 monitor. TWA 2ppm. Can wear an acid gas respirator at 5ppm. Explosive limit N/A. Health Effects: Coughing, watering eyes, chest tightness, and sore throat. Characteristics: Nose and throat irritation.

6.6.4 HAZARD COMMUNICATION

There are several hazardous substances used and produced in the plant that could cause serious injury or loss of life if not handled correctly. The Plant Safety Department has a complete set of Material Safety Data (MSDS) sheets for these substances. These sheets explain First Aid procedures and proper use of protective equipment when handling these chemicals. The MSDS sheets are located in the Administration Building foyer. Your CMR or Plant Safety personnel can explain the use of MSDS sheets and help you locate them.

6.6.5 ASBESTOS ABATEMENT

Asbestos: There is Asbestos Containing Materials (ACM) at the plant. Identified ACM has been labeled. There maybe ACM that has not been identified and labeled. Asbestos can be in floor tile, pipe, mechanical insulation, plaster, fireproofing, roofing materials, brake pads, and gaskets. Undisturbed, it is perfectly safe. Asbestos has microscopic fibers which, when released, enters the air. Once in the air, it can enter the lungs causing a disease. Never work on or touch any material that has been labeled, or is suspected as being, asbestos without the proper training. Stop your work and contact your assigned CMR or a member of the plant Safety and Health Team immediately.

The Monsanto Soda Springs Plant contains Asbestos Containing Materials (ACMs). Identified ACMs have been affixed with hazard warning labels to notify employees of the health hazards associated with asbestos exposure. There may be ACMs in the Plant which have not been identified and labeled. During the course of your work, assume that insulation, surface and roofing materials, gaskets, wallboard and floor tiles may contain asbestos, especially if constructed prior to 1980. Only approved laboratory tests are valid for confirming or denying the presence of ACM. Contact ESH with any questions. Asbestos containing material has been identified and labeled in the following areas:

*Scale Room *Laboratory *Furnace Buildings
*Raw Ore Building *Training Building *Boiler Building

I have read and understand this asbestos notification form.

Name: ___________________________Date: _________
Company: _____________________________________

6.6.7 LEAD EXPOSURE

Prior to any dismantling or demolition, you must contact your CMR, who will set up a hazard assessment for possible lead presence.

Do not torch, cut, weld or grind on paint or galvanized material until you have had a hazard assessment.

Employees will be trained if they are to be working in an area with lead prior to starting the work.

6.6.8 RADIATION SAFETY

1. All work to be conducted on or around fixed and portable nuclear regulated material must be conducted under the full knowledge of the plant Radiation Safety Officer (RSO). Notify the CMR they will work with you to inform the RSO. Only properly licensed individuals may conduct such work in the plant.

2. All work conducted in the vicinity of nuclear sources at the plant may require lock out of the source material. Each operating unit with such sources will have lock out plans established. Only designated Monsanto personnel are authorized to secure such sources.

3. All nuclear regulated material will have the proper warning signs and labels affixed. It is the responsibility of each contractor to be aware of these signs and understand the safe practices when working around nuclear material.

4. Damage or incidents involving nuclear material and their holders must be reported immediately through the CMR to the plant RSO.

Radiography

1. All contractors will use extreme caution and safety measures to ensure no employees are exposed to unnecessary radiation. The following guidelines have been established to provide employees working near radiography:

   a.) Radiographers must properly barricade for radiation.

   b.) Before using radiography, your CMR will notify the Site RSO.

6.7.1 CRANES AND HOISTING EQUIPMENT

Crane & Picker Requirements:

1. When lifting material with a crane:

    a.) Know the appropriate hand signals

    b.) Make sure load is secured

    c.) Never stand under the suspended load

    d.) Only one person should give the hand signals

    e.) Signal man must always be in plain view of the operator

    f.) Always follow the load chart

    g.) Lifts over five tons require a critical lift plan

2. Only qualified personnel are allowed to operate cranes or pickers.

3. No crane or picker will be left unattended with a suspended load.

4. A tag line that can be controlled via ground man shall be used when swinging, lifting or transporting a load with a picker or crane.

5. Avoid suspending loads for extending periods of time. Either land the load or tie it off.

6. Never ride on a load or allow others to do so.

7. A Critical work plan must be filled out and used for:

    a.) All lifts exceeding 5 tons

    b.) When lifting over process lines (i.e. steam, phossywater)

    c.) When lifting personnel in man baskets.

Safety Note: Ensure electrical lines are evaluated for proper clearance requirements.

MONSANTO

Crane Lift Plan

This work instruction checklist is required for all lifts exceeding (5)tons.

Location Date of lift
Load Description ______
Lift Description ______

A. Weight:

1. Equipment Condition New ☐ Used ☐
2. Weight empty ______lbs
3. Weight of headache ball ______lbs
4. Weight of block ______lbs
5. Weight of lifting bar ______lbs
6. Weight of slings and shackles ______lbs
7. Weight of jib ______lbs
8. Weight of headache ball on jib ______lbs
9. Weight of cable (load fall) ______lbs
10. Allowance for unaccounted material in equipment ______lbs
11. OTHER______ ______lbs

TOTAL WEIGHT ______lbs

Source of Load Weight ______
name plate, drawings, calculated, etc.

Weights verified by: (name) ______

B. Jib:

Erect______ Stored______

1. Is the jib to be used? ______
2. Length of jib______
3. Angle of jib______
4. Rated capacity of jib______

C. Crane Placement:

1. Any deviation from a smooth solid foundation in the area? ______
2. Electrical hazards in the area? ______
3. Obstacles or obstructions to lift or swing?______
4. Swing direction and degree (boom swing)______

D. Cable:

1. Number of parts of cable______
2. Size of cable ______

Crane inspected by:______
Functional test of crane by:______
Designated Groundman:______
Wind conditions at time of lift______

E. Sizing of slings

1. Sling selection
   - a. Type of arrangement ______
   - b. Number of slings in hookup ______
   - c. Sling length ______
   - d. Rated capacity of sling ______
2. Shackle selection
   - a. Capacity ______
   - b. Shackle attached to load by: (name) ______
   - c. Number of shackles ______

F. Crane

1. Type of crane ______
2. Crane capacity ______
3. Lifting arrangement
   - a. Max. distance - Center of load to center pin of crane
   - b. Length of boom ______
   - c. Angle of boom at pickup ______degrees
   - d. Angle of boom at set ______degrees
   - e. Rated capacity of crane under most severe lifting conditions (from chart)
     1. Over rear ______lbs
     2. Over front ______lbs
     3. Over side ______lbs
     4. From chart - rated capacity of crane for this lift ______lbs
     5. Maximum load on crane ______lbs
     6. Lift is what percentage of crane's rated capacity ______%

G. Pre-lift Checklist

1. Matting acceptable	Yes	No
2. Outriggers fully extended	Yes	No
3. Crane in good condition	Yes	No
4. Swing Room	Yes	No
5. Head room check	Yes	No
6. Maximum counterweights used	Yes	No
7. Tag line used	Yes	No
8. Experienced operator	Yes	No
9. Experienced groundman	Yes	No
10. Experienced rigger	Yes	No
11. Radios used	Yes	No
12. Anti-two block device used	Yes	No

Note: If radios are used they must be dedicated crane radios.

Special instructions or restrictions for crane, rigging, lift etc. ______

Diagram crane an load placement	Diagram rigging configuration

Multiple crane lifts require a separate lift plan for each crane.

Any change in the configuration of the, placement, rigging, lifting scheme, etc. or changes in any calculations require that a new lift plan be developed.

When lifting personnel with a crane obtain the Hazardous work permit titled: Lifting Personnel with Cranes

Signatures:

Project Leader / Planner ___________________________

Crane Operator ___________________________

6.7.3 MOBILE/POWERED CONSTRUCTION EQUIPMENT

VEHICLE SAFETY/TRAFFIC:

1. Any Vehicle that enters the plant must stop at the guard station and get a vehicle pass, which states the business and destination of that vehicle.

2. All vehicles entering plant gates will be inspected by the Vehicle Equipment Checklist.

3. Vehicles shall be escorted into the plant and to their destination by the responsible department.

4. After the driver of the visiting vehicle has concluded their business, they must notify the guard at ext. 1310 (front entrance) or at ext. 1480 (back entrance/West gate) and the escort will lead them back out of the plant. The driver of the vehicle must return their pass to the guard.

5. The speed limit within the plant is 15 MPH unless otherwise posted.

6. Headlights or a strobe must be turned on when vehicles are traveling in plant.

7. Vehicle or pedestrian traffic is not allowed in the pot carrier, nodule stacking or belt filter press/ore screen house areas without approval from the operating department supervisor. If permission is needed, see your CMR.

8. A danger exists while transporting molten slag and metal, pot carriers have the absolute right of way on slag haul roads. All personnel will avoid slag haul roads unless absolutely necessary.

9. All persons will keep a safe distance from moving heavy equipment until the attention of equipment operator has been gained and eye contact made.

10. Vehicles entering the plant shall observe all railroad signs and must cross tracks only at regular crossings.

11. No person is to ride on any vehicle except as a passenger inside the cab. Seat belts are required.

12. Nonsmoking signs are posted and shall be observed at all times. Smoking is not permitted within 20 feet of gasoline and diesel fuel pumps.

13. Mobile equipment engines must be shut off prior to fueling.

14. Haulage units always have the right of way on all roads; this includes the quartzite road.

15. The speed limit on haul roads is 35 MPH.

16. Use of cell phones while driving a vehicle in the plant is prohibited.

CONTRACTOR VEHICLE/TOOL INSPECTION CHECKLIST

Date Inspected: ______________________________

Driver Name: ______________________________

Company: ______________________________

License Number: ______________________________

Inspected By: ______________________________

CHECK LIST	NA	OK	DEFAULTS
General Condition & Housekeeping			
Tires			
Brakes			
Parking Brakes			
Glass			
Doors			
Rear View Mirrors			
Head Lights			
Warning Flashers			
Tail Lights			
Horn			
Back-Up Alarm (if view through rear window is obstructed)			
Fire Extinguisher			
Exhaust System			
Seat Belts for all employees			
Strobe Lights Required (if not equipped w/ head lights)			
EQUIPMENT/TOOLS			
Ladders			
Hoisting equipment			
Hand Tools			
Fuel Containers Safety Can w/ spring loaded lid & flame arrest			
Hoses			
Other Equipment Applicable			

FORKLIFT AND BOBCAT:

1. Only qualified operators who have successfully completed the forklift-training course are permitted to operate a forklift.

2. Only qualified personnel are allowed to operate a Bobcat.

6.8.0 WASTE MANAGEMENT

Compliance with environmental laws and regulations is a condition of doing business with Monsanto. All questions regarding environmental requirements should be directed to the CMR who will then contact the Environmental Group.

There are two major environmental areas that all contractors entering the plant need to be aware of:

1. Chemical use/disposal

   All chemicals to be used on Monsanto property shall be approved through the Environmental Department before being brought on site. The CMR is responsible for making sure that the contractor provides a list of chemicals that will be used during the project, along with a MSDS for each chemical. This information will be provided to the Environmental Group for their review. A wide variety of chemicals used during cleaning, painting, degreasing and other operations become RCRA hazardous wastes when they are used or spent. These chemicals may include: solvents, acids, soldering, brazing, fluxing, welding, scraping waste and sandblasting waste. Any questions regarding a chemical's regulatory status, including proper storage and disposal, should be directed to the CMR. The CMR will contact the Environmental Department to ensure that used/unused chemicals or generated waste materials are handled, recycled, or disposed of properly. Unused leftover chemicals brought on-site shall be removed by the contractor from the site to be returned to the manufacturer. Used chemicals or wastes must be left on-site, as they are considered Monsanto-generated wastes. Monsanto's Environmental Department will ensure that proper recycling or disposition of waste occurs.

2. Releases of Chemicals to the Environment

   It is the responsibility of the CMR and the contractor to know the reportable quantities for all chemicals being used on each respective project. A reportable quantity is the amount of a substance which, when released to the environment, triggers state or federal reporting requirements. The CMR will receive this information from the Environmental Group during the initial chemical approval (prior to bringing the chemical on site). If a release of a reportable quantity of a chemical occurs, the contractor should IMMEDIATELY report the release to federal, state and local regulatory authorities and then inform your assigned CMR or the Environmental Group. If the contractor is unfamiliar with release reporting requirements, the CMR will provide assistance with the calls. If your CMR is not available, contact a plant crew supervisor or Lead OME.

Work Instructions for Bringing Chemical Products into the Plant

1. Check the Evaluated Chemicals List found in the Plant ESH Folder for your product. Is the chemical on the list?

2. If it is on the list and has been approved, notify purchasing that the chemical has already been approved and continue with your order. Note any safety and/or environmental concerns, which may affect how you utilize the chemical. Reminder: Only order the amount of product needed for the project. Also, ensure that unused product can be sent back to the vendor immediately after a project is finished to eliminate the need to dispose of a once useful product as waste.

3. If it is on the list but has not been approved, find an alternative product and return to step 1.

4. If the product is not on the list, fill out box 1 of the chemical evaluation form found in the plant ESH Folder and attach a copy of the MSDS (this can be obtained from the vendor). Give the form and the MSDS to the IH Specialist or an environmental engineer.

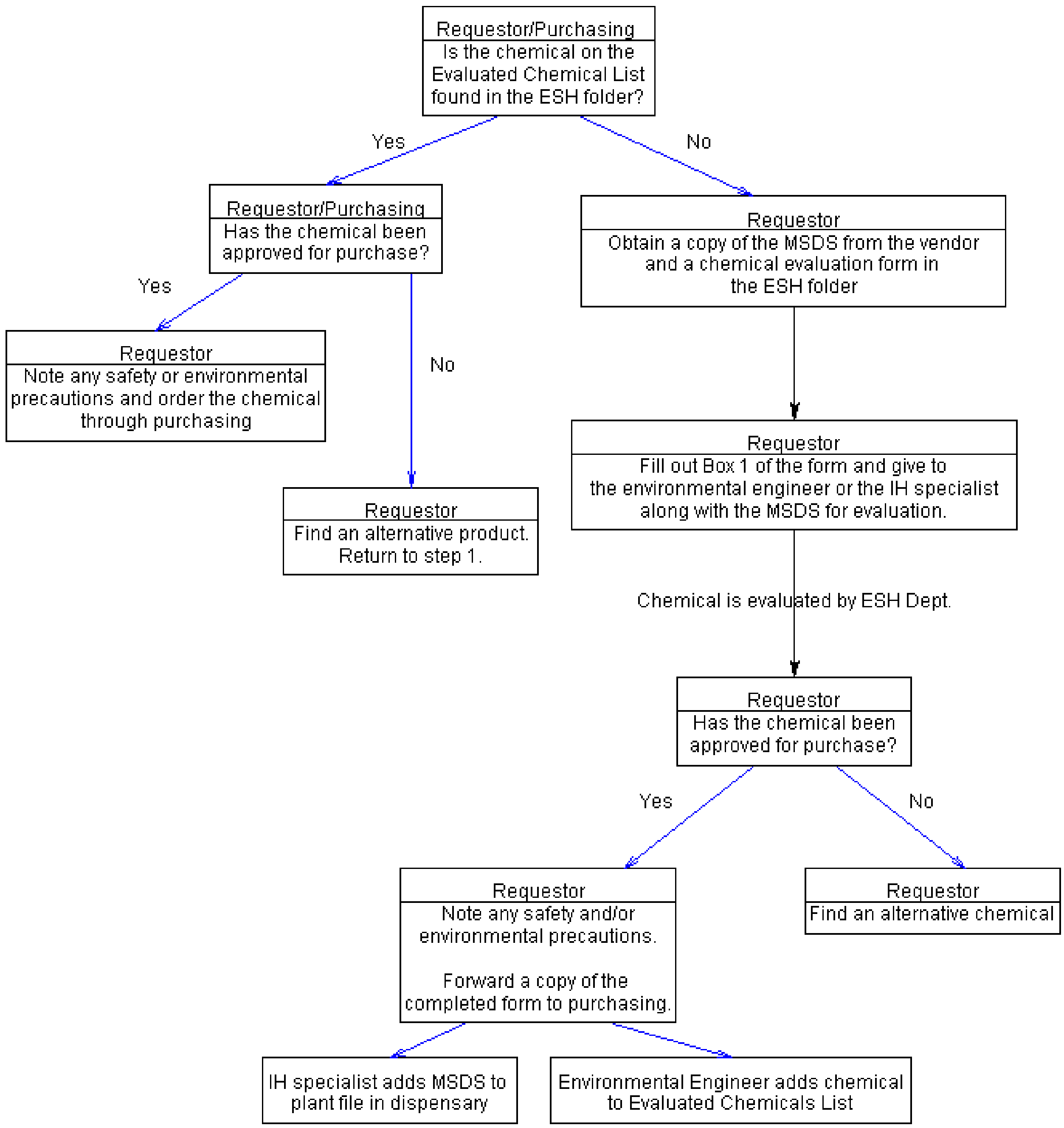
5. When the completed form is returned to you, has the product been approved for purchase?

6. If yes, note any safety and/or environmental concerns, which may affect how you utilize the product, and forward a copy of the completed evaluation to purchasing. Purchasing will not order any chemical product unless they receive a “Chemical Ordering Evaluation Form” for the product to be ordered.

7. The IH Specialist will add the MSDS to the plant files located in the administration-building foyer. The environmental engineer will also add the chemical to the Evaluated Chemicals List.

8. If not, find an alternative product and return to step 1.

Work Instructions for Bringing Chemical Products into the Plant



NEW CHEMICAL EVALUATION FORM

BOX 1: TO BE COMPLETED BY REQUISITIONER

Date ____________ Requested By: ___________________________ Department: ___________
PRODUCT NAME:____________ Manufacturer: _____________________ Phone #: ________
Area of Use: _________________ Used for: ______________________________
Type of Requisition: [ ] One time use* [ ] Permanent Order: Amt/year: _____________
*Has the vendor agreed to take back any unopened containers? [ ] yes [ ] no
If no, why? ________________________
Vendor's Name & Phone Number ___________________
REQUISITION #: ____________ Additional Information: ______________________________
____

****ATTACH MSDS PRIOR TO SENDING TO ENVIRONMENTAL & SAFETY FOR REVIEW****

BOX 2: HEALTH & SAFETY (IH Specialist)

[ ] NFPA [ ] Not Applicable

Health	0	1	2	3	4
Fire	0	1	2	3	4
Reactivity	0	1	2	3	4

[ ] Hazard Communication [ ] Not Applicable

Chemical Name: ______________ CAS Number: ____________________
Carcinogen [ ] Known [ ] Suspected [ ] Not Applicable
TLV's [ ] TWA ______ppm or mg/m^3 [ ] STEL______ppm or mg/m^3 [ ] Not Applicable

RECOMMENDATIONS:

[ ] O.K. for purchase [ ] Purchase Only as needed [ ] Do Not Purchase
Comments: ____
Reviewed By: ______________________________________ Date: _____________________

HEALTH AND SAFETY PRECAUTIONS

____
____

BOX 3: ENVIRONMENTAL (Environmental Engineer)

[ ] RCRA [ ] Not Applicable
Characteristic Hazardous Waste: Ignitable ____ Corrosive ____ Reactive ____ Toxic ________
Listed Hazardous Waste: F listed _____ K listed _____ U listed _____ P listed _______

[ ] CERCLA [ ] Not Applicable
Hazardous Substance: ______________________ Reportable Quantity: ______________
Hazardous Substance: ______________________ Reportable Quantity: ______________

[ ] EPCRA [ ] Not Applicable
[ ] Hazardous Chemical [ ] Extremely Hazardous Substance
Threshold Planning Quantity: ________________________

RECOMMENDATIONS:

[ ] O.K. for purchase [ ] Purchase Only as needed [ ] Do Not Purchase

Comments: ____

Reviewed By: ______________________________ Date: __________________

ENVIRONMENTAL PRECAUTIONS & RESTRICTIONS

____

____

6.9.1 SUBSTANCE DETECTION

General Requirements:

In the general requirements for Low-Risk and High-Risk contractors, refer to 5.0 Contractor/Guest ES&H Guidelines, 5.9.1 Substance Detection.

This policy is in effect for all Monsanto Soda Springs locations including the Rock Springs, Wyoming Calciner facility, and all affiliated off site mining operations and properties (hereinafter referred to as Soda Springs Facilities).

Contractors that do not have a substance abuse policy consistent with these guidelines will not be allowed on a Soda Springs facility without a Monsanto management exception.

All contractors have been classified into one of two categories, High-Risk or Low-Risk. This classification was determined as to the type of work that the contractor performs at the Soda Springs Facilities.

Requirements for Both Low-Risk and High-Risk Contractors:

Low-Risk and High-Risk contractors must maintain a copy of an executed **Substance Abuse Policy Statements (Exhibit A)** for each contract employee who works at a Soda Springs Facility; and

Low-Risk and High-Risk contractors must present at the time of site orientation an executed **Substance Abuse Policy Statement (Exhibit A)** for each contract employee undergoing site orientation.

If the Certified Monsanto Representative (CMR) suspects any contract employee is impaired due to alcohol, drugs or other substances, that contract employee will be asked required to immediately leave the Soda Springs Facility and not return until that contract employee has undergone a substance abuse test verifying that he or she is in fact substance free.

Additional Requirements for High-Risk Contractors:

A. Testing Program: All High-Risk contractors must implement one of the two following substance abuse testing programs, although please note that Monsanto prefers that its High-Risk contractors implement the first option:

   Option One: Contractor must execute and provide to Monsanto the **Contractor Employer Substance Abuse Verification (Exhibit B)** and must implement a substance-abuse testing program that contains the following elements:

1. Prior to Working at Soda Springs Facilities – Contractor must have a program that documents that each contract employee working at a Soda Springs facility has passed a substance-abuse test prior to that individual starting work at any Soda Springs Facility.

2. Random Testing – Contractor must have a documented program providing evidence that at least 35 percent of its work force who have worked at Soda Springs Facilities has been randomly tested during the prior year. The testing of the 35 percent must occur evenly over an annual time frame. Testing all personnel on a single day does not qualify as random.

Option Two: Contractor must execute and provide to Monsanto the **Contractor Employer Substance Abuse Verification (Exhibit B).** Within 15 days prior to any contract employee beginning work at the Soda Springs Facilities, and within six months of any previous test, Contractor must test that individual and maintain executed **Contractor Employee Substance Abuse Verification(s)** for that test(s). Contractor will provide to Monsanto a copy of the executed **Contractor Employee Substance Abuse Verification (Exhibit C)** at the time of that individual's site orientation. This testing requirement applies for as long as the contract employee continues to work at the Soda Springs Facilities. If there is a 45-day lapse in any assignment to the Soda Springs Facilities for any particular contract employee, contractor must test that individual within 15 days prior to him or her restarting work at the Soda Springs Facilities.

B. Test Requirements: The substance abuse testing conducted pursuant to the above guidelines must be for the following listed substances (or other such substances as indicated in writing by Monsanto) at levels set forth in the Federal Register of Health and Human Services Guidelines published in the Federal Register on April 11, 1988 [53 F.R. 11970], and any amends thereto.

Amphetamines
Cannabinoids (THC)
Cocaine Metabolite
Opiates
Phencyclidines

All tests shall be performed in a Substance Abuse and Mental Health Services Administration (SAMHSA) certified laboratory.

C. Positive Results: If a contract employee tests positive for substance impairment or contractor suspects a contract employee of substance impairment, contractors shall:

1. Immediately remove the contract employee from the Soda Springs Facilities.
2. Inform the CMR Leader and Purchasing Lead.

A contract employee who has tested positive for substance impairment shall not be allowed to return to the Soda Springs Facilities until the CMR Leader or Purchasing Lead has been provided verification and documentation that the contract employee has successfully completed a recognized substance abuse rehabilitation program.

EXHIBIT A

SUBSTANCE ABUSE POLICY STATMENT

Employee Name: ______________________________________

Contractor Name: _____________________________________ ("Company")

In connection with your employment, you may be assigned to work on the premises of Company's client, Monsanto Company ("Monsanto").

The use, possession, sale and distribution of alcohol or controlled, illegal or unauthorized substances, or the presence of an individual testing positive under Company's drug testing programs for such substances for non-medical reasons, are prohibited on any Monsanto work location, including project sites. Illegal drugs include, among others, marijuana, hashish, heroin, crack/cocaine and hallucinogens.

Entry to any Monsanto work location, including project sites, offices and vehicles, is conditional on Monsanto's right to search the entrant's personal effects and vehicle for prohibited drugs and paraphernalia, alcoholic beverages, or possession of unauthorized property or equipment. The Certified Monsanto Representative (CMR) has the right to remove any contract employee from any of the Soda Springs Facilities until a substance abuse test can verify that the contract employee is in fact substance free.

Violation of this policy or refusal to submit to a search or drug testing will be cause for immediate termination of Permission/Authorization to work on Monsanto's premises. I agree to abide by Monsanto's reasonable suspicion.

I HAVE READ AND UNDERSTAND THE ABOVE POLICY.

______________________________________ ______________________

Employee Signature Date

EXHIBIT B

CONTRACTOR EMPLOYER SUBSTANCE ABUSE VERIFICATION

I hereby certify that our Company substance abuse program meets the standard set forth in the Monsanto Soda Springs site-specific document 6.9.1 as outlined in Option One or Two. I also agree to periodic audits of our substance abuse testing program to provide evidence that the program is in conformance.

Our selected option for the Soda Springs Site High Risk Contractor is:

Option One______ Option Two ______

Name of Contract Company: ____

By:____

Title:____

Date:____

Please fax or return the above information:

Monsanto Company
Attn: Matt Kirby
(208) 547-1253 Office
(208) 547-3763 FAX
sodasprings.contractor-guest@Monsanto.com

EXHIBIT C

CONTRACTOR EMPLOYEE SUBSTANCE ABUSE VERIFICATION

Name of Employee: ____

Last four digits of Social Security Number: ____________________________

Date Sample Taken: ____

Name of Testing Laboratory: ____

Test Utilized: ____

Negative Test Results* Yes________ No_________ *Do Not Send Actual Test Results

I HEREBY CERTIFY THE ABOVE TEST RESULTS TO BE CORRECT TO THE BEST OF MY KNOWLEDGE.

Name of Contract Company: ____

By:____

Title:____

Date:____

Please fax or return the above information:

Monsanto Company
Attn: Matt Kirby
(208) 547-1253 Office
(208) 547-3763 FAX
sodasprings.contractor-guest@Monsanto.com

This page was intentionally left blank.

Appendix H
Degerstrom Ore Haul Road Travel Requirements

This page was intentionally left blank.

ORE HAULROAD TRAVEL REQUIREMENTS

VISITORS

Haulroad Safety

There are two different types of haulroads used by Degerstrom Ventures. The system of roads used for the hauling of materials between the pit and dumps or pit and ore stockpile. This system is referred to as simply haulroads. The other type of haulroad is the Ore Haulroad which is a 19 mile paved haulroad used for hauling ore from the tipple to the ore stacker near the Monsanto Plant Site.

Both of these haulroads share some safety rules but also have some safety rules that are specific to that particular road. It is important to understand the differences between these two road systems and obey the traffic rules that assure personal safety and help maintain safe haulroad traffic.

Sections of the haulroads in the mine are shared through a co-operative agreement with Agrium. These present additional hazards and restrictions that are also addressed in this section.

Right hand traffic is observed on all roads to, from and at the mine; unless otherwise posted. Large pieces of mobile equipment have very limited visibility, large blind spots, and often have extremely long stopping distances: so be aware of this and give mobile equipment plenty of room when approaching them from any direction. It is important to be cautious, pay attention to what is going on around you at all times and particularly avoid equipment in blind spots. Always stay in areas where you can see the operators of mobile equipment – ***"See & Be Seen"*** when traveling on all roads in and around the mine. *If you cannot see the operator, the operator cannot see you.*

General Haulroad Safety Rules

1) Obey all posted speed limits.
2) Obey all posted warning, advisory, and traffic signs.
3) Always wear seatbelts.
4) Watch for wildlife crossing.
5) Always drive with headlights on.
6) Adjust your speed for weather and road conditions.
7) Loaded haul trucks have the right of way.
8) Always assume that unless you can see the operator they cannot see you.
9) Give plenty of clearance to all mobile equipment. Remember: large equipment has very limited visibility and large blind spots.

10) When following a haul truck stay far enough back that you can see the driver's side mirror, that way the operator can see you.

11) Never approach mobile equipment from the rear. Avoid this large blind spot and approach from the driver's side. Never park directly behind any mobile equipment.

12) Be alert for material that may fall off the beds of loaded trucks.

13) Never drive past, over or around any type of road barricade.

14) Pay attention to horns, alarms and signals on all mobile equipment.

Ore Haul Road

The Ore Haul Road runs from the tipple at the mine to the unloading facility at the plant. This paved road was designed for ore hauling, but the upper portion above the Blackfoot River Road/Ballard intersection serves as the access road to the mine. Traffic between the Ballard intersection and the plant is restricted to ore trucks, service equipment, and small vehicles equipped with the proper two-way radios. All other vehicles must make prior arrangements and/or be escorted.

The Ore Haulroad crosses the Blackfoot River Road at Ballard. Traffic at this intersection is controlled by traffic lights. These lights regulate traffic on the Blackfoot River Road to allow the ore trucks to proceed through the intersection safely, without stopping. This is very important to the operation of the ore trucks, especially when the trucks are loaded with 210 tons of ore. The traffic lights are triggered by trips set in the asphalt prior to the intersection and cycle through a preset time, which allows the ore trucks to pass through the intersection before the lights change. It is important to avoid driving over the trips and triggering the traffic light cycles, tripping them may effect the cycle time and interfere with an approaching ore truck. The trips are clearly marked on the asphalt and with signs. The ore trucks have the right of way, so avoid driving over the trips, stay clear of approaching traffic, and any ore trucks that may be following behind you.

Ore trucks may be parked on the ore haul road during lunch break and if they are experiencing mechanical problems. When you are approaching these parked trucks slow down and use caution, the operator or mechanics may step out from under or around these parked trucks.

Ore Haulroad Safety Rules

1) Obey all posted speed limits.

2) Obey all posted warning, advisory, and traffic signs.

3) Always wear seatbelts.

4) Always drive with your headlights on.

5) Watch for wildlife crossing.

6) Adjust your speed for the weather and road conditions.

7) Ore trucks have the right of way.

8) Stay as far to the right as possible when traveling the Ore Haulroad, especially when meeting ore trucks.

9) Use extreme caution when passing an ore haul truck. Never pass on corners or hills where visibility is limited.

10) Avoid driving over the traffic light trip at Ballard and Conda crossings.

11) Never park on the paved portion of the haulroad. Always park in a spot that is clear from traffic. In case of a mechanical problem, park as far to the right as possible and turn on emergency flashers.

12) Slow down and use caution when approaching and passing ore trucks that are stopped on the ore haulroad. Operators and mechanic may be walking around these stopped trucks.

Haulroads at the Mine

There are numerous roads throughout the mine itself. These roads are used for a variety of purposes such as, to accessing various areas of the mine, drilling & blasting, and surveying. The haulroads are designed for specifically for the hauling of mine ore and waste materials.

The traffic patterns on these roads change continually during each shift, as needed. The basic rule here is to stop before entering these roads, look at the flow of the traffic and then follow. This has been posted at main entrances to haulroads with signs that read – "STOP LOOK and FOLLOW." Remember it is very important to ***"See & Be Seen."***

During drilling, loading and blasting some roads may be barricaded with signs, traffic cones or other means to prevent access to the area. This is done to prevent access to a blasting area before, during and after a shot. Never enter these barricaded areas.

Mine Haulroad Safety Rules

1) Obey all posted speed limits.
2) Obey all posted warning, advisory, and traffic signs.
3) Always wear seatbelts.
4) Drive with your headlights on.
5) Adjust your speed for weather conditions.
6) Loaded haul trucks have the right of way.
7) Never enter areas that have been barricaded.
8) **Do Not Pass** any mobile equipment or vehicles unless you have received clearance (by radio/hand signals) from the operator of that piece of equipment.
9) Be alert for material that may fall from the bed of loaded haul trucks. Keep plenty of space between you and a haul truck when following up any grades.
10) Give plenty of clearance to all mobile equipment. These large pieces of equipment have very limited visibility and large blind spots.
11) When following a haul truck, stay far enough back that you can see the driver's side mirror, that way the operator can see you.
12) Never enter marked or barricaded blasting areas.
13) Never park directly behind any mobile equipment. Always park on the driver's side. If you cannot see the operator, the operator cannot see you.
14) Pay attention to horns, alarms, and signals from mobile equipment.
15) Never park on the haulroad. Always park in a spot that is clear from traffic. In case of a mechanical problem, park as far to the right as possible and turn on emergency flashers.

GENERAL REQUIREMENTS:

- All visitors planning to drive on any haul roads shall successfully complete a specific hazard awareness training session presented by Degerstrom Ventures.
- All visitors on any haul road shall obtain Degerstrom Ventures permission for access.
- All visitors must check in and out at the Degerstrom Ventures Office before and after each visit.
- Vehicles using haul roads shall not trip the traffic lights at the Conda or Ballard Crossings.
- Posted speed limits & traffic requirements shall be followed when using the haul roads.
- Seatbelts shall be worn at all times when using the haul roads.
- Vehicle headlights shall be used when traveling the haul roads.
- Ore haul trucks are considerably larger than regular semi trucks. It requires much longer distances to stop them and they are much less maneuverable.
- Never pass a haul truck traveling on the haul road.
- When approaching a haul truck stopped along the haul road – SLOW DOWN & SOUND HORN before passing.
- Be alert for wildlife and livestock that may be on, along or crossing the roadway.
- Leave all gates along the haulroads the way that you found them.

SPECIFIC REQUIREMENTS:

1. From the stacker dump station to the gravel pit, visitors can use the haul road if they have completed the general requirements.
2. From the gravel pit to the corrals by the Fish Pond, visitors must complete the general requirements and have an approved Monsanto or Degerstrom Ventures' escort at all times.
3. From the corrals by the Fish Pond to the Ballard light, visitors can use the haul road if they have completed the general requirements.
4. From the Ballard lights to the Degerstrom Ventures Office, visitors with business to complete at the mine can use the haul road by following the requirements of the road signs.
5. From the Degerstrom Ventures Office to the tipple and mine, visitors must have a Monsanto or Degerstrom Ventures' escort or complete the general requirements plus obtain Degerstrom Ventures permission.

Degerstrom Ventures haul trucks, equipment and other vehicles shall always have the right-of-way and all vehicles shall yield to them. Visitors shall travel at their own risk. Degerstrom Ventures shall not be held responsible for their safety.

USE OF THE HAUL ROAD IS A <u>PRIVLAGE</u> GRANTED BY DEGERSTROM VENTURES. ANY VIOLATIONS OF THIS POLICY WILL RESULT IN REMOVAL FROM THE PROPERTY

RELEASE FORM (Individual)

In consideration of the permission given to me by DEGERSTROM VENTURES and/or MONSANTO/P4 PRODUCTION, L.L.C. to enter upon land owned or leased by DEGERSTROM VENTURES for the sole and exclusive purpose of ____, I, the undersigned, do hereby:

(i) Voluntarily assume all risk, whether known or unknown, of accident, loss and damage to myself and others and property resulting or arising from or in any way connected with my presence on said land;

(ii) Release and discharge DEGERSTROM VENTURES and MONSANTO/P4 PRODUCTION, L.L.C., and its successors and assignees, and its and their respective directors, officers, employees, and agents, from any and all claims, obligations, liabilities, losses, damages, costs, or expenses of any kind, (including, without limitation, attorney's fees), whether known or unknown, sustained as a result of or arising from or in any way connected with my presence on said land; and

(iii) Agree to protect, indemnify, and save harmless DEGERSTROM VENTURES and MONSANTO.P4 PRODUCTION, L.L.C., their successors and assignees, and its and their respective directors, officers, employees, and agents, from any and all claims, demands, causes of action, losses, damages, obligations, liabilities, penalties, costs, and expenses of any kind (including, without limitation, amounts paid in settlement and attorney's fees and expenses), whether known or unknown, suffered by, imposed upon, incurred by, asserted against, or arising in any way against, DEGERSTROM VENTURES and MONSANTO/P4 PRODUCTION, L.L.C. or any of their successors or assignees, or the directors, officers, employees, or agents of any of them in connection with my presence on said land regardless of whether caused by the negligence of DEGERSTROM VENTURES and MONSANTO/P4 PRODUCTION,L.L.C. or their directors, officers, employees, or agents.

IN WITNESS WHEREOF, I hereunto set my hand this __________ day of ____________, 200_.

____

Address: ____

This page was intentionally left blank.

Appendix I
MWH EH&S Procedure No. 811, Drilling Safety

This page was intentionally left blank.

811 DRILLING SAFETY

I. PURPOSE

This procedure provides information on the hazards, regulatory requirements, and safe work practices for using drilling equipment and performing drilling operations. This procedure address all forms of drilling, including cable tool, rotary, geo-probe, rotosonic, and hollow-stem auger drilling used for most geotechnical, investigation, groundwater, and subsurface exploration drilling projects.

II. REGULATORY REVIEW

There are no specific Occupational Safety and Health Administration (OSHA) regulations for drilling activities; however, general guidelines may be found in 29 CFR 1926.800, *Underground Construction,* section (q). In addition, some of the OSHA standards that are applicable to drilling operations include:

29 CFR 1926, Subpart E, *Personal Protective and Lifesaving Equipment*
29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response*
29 CFR 1926.251, *Rigging Equipment for Material Handling*
29 CFR 1926.307, *Mechanical Power-transmission Apparatus.*
29 CFR 1926.550, *Cranes and Derricks*
29 CFR 1926, Subpart Z, *Toxic and Hazardous Substances*

Some state OSHA plans may have additional requirements for drilling. Also, the client may have specific permits or operation practices that will be applicable to MWH drilling operations. Contact the Regional ES&H Manager for additional information.

Additional information may be obtained from the following non-regulatory references:

- ATEC Associates, Inc. 1991. *Drilling Safety: Working in the Danger Zone.*
- Diamond Core Drill Manufacturers Association (DCDMA) and the National Drilling Contractors Association (NDCA). *Drilling Safety Guide.* National Drilling Federation.
- Driscoll, Fletcher. 1989. *Groundwater and Wells.*
- West Hazmat Drilling. 1991. *Workplace Injury & Illness Prevention Program.*
- U S Army Corps of Engineers, EM385-1-1, *Safety and Health Requirements* Chapter 16.

III. ROLES AND RESPONSIBILITIES

A. ES&H Director

The ES&H Director is responsible for establishing a program that provides for the protection of MWH employees and subcontractors and that meets the applicable regulatory requirements for the use of, and work adjacent to, drilling equipment.

B. Regional ES&H Manager

The Regional ES&H Manager is responsible for:

- Ensuring that this procedure is implemented within his or her region.
- Ensuring assessments are completed to verify compliance with regulatory and procedure requirements.

C. ES&H Representative

The ES&H Representative is responsible for the following:

- Evaluating work sites and activities to ensure drilling operations are conducted in compliance with the requirements of this procedure and regulatory standards.
- Verifying that equipment inspections are completed and that equipment used is in serviceable condition.
- Verifying that employees are following safe work practices for work with, and adjacent to, drilling operations.

D. Employee

Each employee is responsible for the following:

- Understanding the hazards and following the required safe work practices for drilling operations.
- Using the personal protective equipment (PPE) specified for the task being performed.

IV. DEFINITIONS

Annulus: The space between the drill string (length of connected drill pipe) or casing and the wall of the borehole or outer casing.

Auger Drilling: A general type of drilling in which the borehole is drilled by rotating augers (either hollow-stem or solid-stem), and cuttings are removed by being pushed up the "flights" (corkscrew-like flanges) of the augers. (Note: the term "flight" is often used to indicate the lengths of hollow-stem or solid-stem augers, as well as the flanges on the augers.) Hollow-stem augers allow drillers to send split-spoon samplers down through the center of the augers, thereby eliminating the need to pull out the augers first. Solid-stem augers are used for smaller-diameter holes and for drilling through formations where more concentrated downward force is necessary.

Bit: The cutting tool attached to the bottom of the drill string. Used in rotary drilling.

Blowout: An uncontrolled escape of drilling fluid, gas, oil, or water from the well caused by the formation pressure being greater than the hydrostatic head of the fluid in the borehole. Also, an uncontrolled escape of grout from the borehole or well caused by malfunctioning pressure grouting apparatus.

Cone Penetrometer Testing (CPT): This was originally a method of performing geotechnical evaluations of subsurface soils, now additionally used to obtain rough estimates of aquifer properties. The CPT rig uses a direct-push method to advance a cone equipped with electronic sensors. As the cone is pushed downward, measurements are collected by the sensor and are recorded on the CPT aboveground equipment. Some CPT rigs are also capable of collecting soil gas, soil and groundwater samples at shallow depths (usually less than 50 feet).

Cuttings: Formation particles obtained from a borehole during the drilling process.

Direct-Push Soil Gas/Soil/Groundwater Sampling: A method of sampling either soil gas, soil, or groundwater by advancing a small sampling probe. The probe is hydraulically pushed downward, generating virtually no cuttings and eliminating waste disposal concerns. Direct-push sampling is applicable where no permanent wells are desired, and/or where sampling is required at relatively shallow depths (usually less than 50 feet). Direct-push equipment may be truck-mounted (on a vehicle), or mounted on a modified hand truck.

Drill Collar: A length of extremely heavy steel tube. It is placed in the drill string immediately above the bit to minimize bending caused by the weight of the drill pipe.

Drill Pipe: A special pipe used to transmit rotation from the rotating mechanism to the bit. The pipe also transmits weight to the bit and conveys air or fluid, which removes cuttings from the borehole and cools the bit.

Drilling Fluid or Mud: A water-based or air-based fluid used in the well drilling operation to remove cuttings from the borehole, to clean and cool the bit, to reduce friction between the drill string and the sides of the borehole, and to seal the borehole.

Grouting: The operation by which grout is placed between the casing and the sides of the borehole to a predetermined height above the bottom of the well. This secures the casing in place and excludes water and other fluids from the borehole. A pressure grouting operation injects grout from the surface under high pressure, in order to move grout laterally in the subsurface and ensure an adequate seal.

Kelly: A hollow steel bar or pipe that is the main section of drill string to which the power is directly transmitted from the rotary table to rotate the drill pipe and bit. The cross section of the kelly is either square, hexagonal, or grooved. The kelly works up and down through drive bushings in the rotary table.

Limited Access Drill Rig: A type of drill rig, usually equipped with solid-stem augers, which allows drilling in tight spaces or in areas with low overhead clearance (less than 12 feet). Limited access drill rigs may be mounted on a small lawnmower-like vehicle, or on a modified hand truck.

Rotary Drilling: A general type of drilling in which the borehole is drilled by rotating a bit, and cuttings are removed by continuous circulation of a drilling fluid (e.g., mud, water, air, foam) as the bit penetrates the formation. The bit is attached to the lower end of a string of drill pipe, which transmits the rotating action from the rig to the bit.

Rotary Table: A mechanical or hydraulic assembly that transmits rotational torque to the kelly, which is connected to the drill pipe and the bit. The rotary table has a hole in the center through which the kelly passes.

Split-Spoon Sampler: A thick-walled steel tube split lengthwise used to collect soil samples. The sampler is commonly lined with metal sample sleeves and is pounded or pushed downhole by the drill rig to collect samples.

V. PLANNING

A. Training

Only trained and experienced personnel who are familiar with the use, limitations, and maintenance requirements of the equipment are permitted to operate the drill rig. The drill rig must be operated in accordance with the manufacturer's instructions and recommendations.

The drill crew shall be familiar with the hazards associated with the drilling operations, personal protective equipment requirements, location of emergency stops, site-specific safety requirements, and the content of this procedure.

Additional training requirements may be required based on the location of the drilling activities. This training may include:

- Hazardous Waste Operations training if work is conducted at a hazardous waste site.
- Waste management training, where waste streams (e.g., drill cuttings, purge water, decontamination water, contaminated personal protective equipment) will be generated.

Site-specific training requirements will be outlined in the project-specific HASP.

B. Medical Surveillance

There are no medical surveillance requirements specific to drilling activities. However, drilling at hazardous waste sites that involve toxicological hazards may require medical surveillance.

Medical surveillance requirements will be addressed in the Project HASP.

MWH drilling subcontractors are responsible for ensuring that their employees receive medical surveillance as required.

C. Safety Equipment

MWH will provide required PPE and safety equipment for its employees and operations. Subcontractors are responsible for providing all PPE and safety equipment necessary for safe operation. Safety equipment will be provided by the subcontractor as delineated in the subcontract and referenced documents. The minimum safety equipment for drilling activities includes safety-toed boots, hard hats, and safety glasses with side shields. Other safety equipment that may be required for drilling operations includes:

- Hearing protection when working in proximity to drilling machinery.
- Body protection (e.g., gloves and protective coveralls) when chemical hazards exist.

- Detection equipment shall be provided if the exact location of underground utilities cannot be determined.
- Air monitoring instruments shall be provided if the potential for a hazardous atmosphere exists in the drilling location.
- High-visibility warning vests are to be worn by all workers exposed to vehicle traffic.
- Fall protection equipment is required if working from unprotected platforms or surfaces greater that 6 feet above the lower level.

D. Subcontractor Selection and Oversight

The *Subcontractor Safety Program Review Criteria—Drilling Operations*, Attachment A, provides the minimum criteria for subcontractor drilling safety procedures. These criteria will be used by the ES&H Representative or ES&H Staff to review subcontractor programs and procedures

Responsibilities for environment, safety and health are expressly defined in the subcontract terms and conditions, and MWH's ES&H practices in the field are determined based on these defined responsibilities. MWH employees shall not direct the means and methods of the subcontractor's operations or direct the details of corrective actions except when MWH employees are responsible for the work activity by contract.

E. Planning Activities

Depending on the contract with the client, the subcontract with a drilling subcontractor, and the physical location of the drilling operation, MWH, may be responsible for some of the following functions to support drilling operations. The responsible party for these items should be clearly defined in the contract and subcontract requirements and included in the Project ES&H Plan.

1. Utility Location

The location of underground utilities, such as electric, fuel, water, cable, telephone, and sewer (either in service or abandoned), and underground installations such as foundations, underground storage tanks, piping, and any other structures need to be identified before drilling is permitted. Utility companies and/or installation owners shall be contacted to provide exact locations of their equipment or structures. Some states have a one-call phone number for locating underground utilities. Most utilities and call centers require a minimum 48-hour-notice (excluding Saturdays, Sundays, and holidays) to identify utilities before drilling work can begin.

If underground utilities cannot be positively located, or where drilling is performed in areas known or suspected to contain buried objects (e.g. drums, tanks, or cylinders), the area will be surveyed with the aid of audio and radio frequency transmitters and receivers, ground penetrating radar, ultrasonic testing, metal detectors, or other means necessary to ensure safe drilling operations.

Overhead electrical transmission and communication lines also need to be identified. If any portion of the drill rig will be within: 10 feet of electrical lines up to 50kV or 10 feet plus 4 inches for every 10 kV over 50 kV, the utility or other facility operating the system will be contacted to have the lines de-energized.

Access to the work location will also be evaluated. Where rigs must travel under energized electrical lines, clearance will be 4 feet for voltages up to 50kV; 10 feet for voltages over 50kV and up to 345kV; and 16 feet for voltages from 345kV up to 750kV.

2. Permits

The following permits and notifications may be required, depending on state, local, and client requirements. The Regional ES&H Manager should be contracted for assistance in determining applicability.

- Well driller license/certification or Professional Geologist requirements: MWH subcontractors will be required to submit licenses or certifications before subcontract award, where applicable.

- Well installation or abandonment notification: Submittal of a well log or inventory may be required after installation or abandonment.

- A groundwater withdrawal permit may be required for large water withdrawals in some states.

- A "drilling permit" may be required at certain client facilities.

3. Waste Management

Drill cuttings and purge water from uncontaminated soil or ground water shall be appropriately.

When drilling is conducted at hazardous waste sites, the Regional ES&H Manager or designee may be consulted on the proper evaluation, disposal, and decontamination procedures involving potential hazardous waste.

- All waste generated shall be evaluated for appropriate disposal and handled in accordance with the appropriate waste management procedure.

- If drilling involves hazardous waste, MWH decontamination procedures shall be followed. No potentially contaminated equipment shall be permitted to leave the work site.

4. Drilling at Ordnance Explosives (OE) or Unexploded Ordnance (UXO) Sites

If the project site is suspected of OE contamination, the requirements of the ES&H procedure for *Unexploded Ordnance, Open Firing Ranges, and Chemical Warfare Agents,* shall be followed. The following procedures will be implemented, at a minimum:

- Drilling operations on OE sites will not be conducted until a complete plan for the site is prepared and approved by MWH ES&H, and the UXO Safety Officer. OE/UXO avoidance must be conducted during drilling operations on known or suspect OE sites.

- The UXO team will identify and clearly mark the boundaries of a clear approach path for the drilling crews, vehicles, and equipment to enter the site. This path will be, at a minimum, twice the width of the widest vehicle. No personnel will be allowed outside any marked boundary.

- If OE is encountered on the ground surface, the UXO team will clearly mark the area where it is found, report it to the proper authorities, and divert the approach path around it.

- The UXO team will conduct an access survey using the appropriate geophysical instrument over the approach path for avoidance of OE that may be in the subsurface. If a magnetic anomaly is encountered, it will be assumed to be OE and the approach path will be diverted around the anomaly. Only UXO personnel will operate the appropriate geophysical instrument and identify OE.

- An incremental geophysical survey of the drill hole location(s) will be initially accomplished by the UXO team using a hand auger to install a pilot hole. If OE is encountered or an anomaly cannot be positively identified as inert material, Hazardous Toxic Radiological Waste sampling personnel will select a new drill hole location.

- Once a drilling site has been surface cleared and a pilot hole established as described above, the drilling crew or subcontractor will be notified that the site is available for subsurface drilling.

VI. PROCEDURE

A. Safe Work Practices

Only authorized or licensed personnel, based on applicable state or local requirements, shall be permitted to operate drill rigs.

When moving large equipment in a confined area, spotters shall be used. The spotter and equipment operator must use standard hand signals for communication. Spotters shall never place themselves between equipment and fixed structures or equipment.

Drill site work areas shall be demarcated to deter unauthorized individuals from entering the work area.

Personnel not involved in equipment operation shall remain clear of drill rigs.

Personnel shall stay clear of the rotating augers and other rotating components of drill rigs at all times. Stand to the side while tripping and tailing rods and augers. Never stand under the rod/auger or between the rig and service truck while tripping rods or augers.

Stay as clear as possible of all hoisting operations. Loads shall not be hoisted over personnel. Never work around or under drilling rods or augers being hoisted.

Keep footwear and work area free of mud and drilling fluids. Maintain 3 points of contact when mounting and dismounting a drill rig. Do not climb the drill rig mast without the use of fall protection.

Augers shall not be stored standing up and shall be secured from rolling.

Hand tools shall be inspected before use. Wrench jaws must be periodically inspected and replaced when necessary.

Understand and be aware of all pinch points including breakout wrenches, pull down cables, and pulling jacks. These points should be color-coded. Experienced employees must show new employees these pinch points on the first day of work.

Good housekeeping shall be maintained at all times. Litter will be properly stored, and hand tools and other hardware will be properly secured on the drill rig. Before moving a drill rig, a check shall be made for loose tools and hardware.

All work areas, platforms, walkways, scaffolding, and other accessways should be maintained free of materials, debris, obstructions, and substances, such as ice, grease, or oil.

Drill rods and augers should be placed on dunage and secured to prevent movement. Always use a sling or strap while manually handling rods and augers.

Be aware of your footing to prevent slips, avoid stepping between rods and augers to prevent crushed ankles from their movement.

Do not wear loose-fitting clothing or other items, such as rings or watches, that could get caught in moving parts. Individuals with long hair should have it restrained.

Personnel shall not smoke around drilling operations.

Personnel shall wear the appropriate PPE. Minimum protection includes safety-toed boots, hard hats, safety glasses, and hearing protection.

A daily safety briefing shall be conducted with all work site personnel to discuss the work planned for the day and the ES&H requirements.

Unattended boreholes shall be covered or protected to avoid the possibility of animals or people accidentally falling into them.

Wellheads on roads and parking lots should be flush-mounted.

B. Site Preparation

Verify that underground utilities and structures have been located and marked, and overhead utilities de-energized as required.

As applicable, the drilling site shall be prepared, cleared, and leveled, particularly on steep slopes or areas that are covered with dry dead grass and weeds. Care should be taken in constructing pads if extensive cutting into existing slopes or surfaces is required to level the area. Areas where extensive fill is required should be avoided. Compaction is recommended if significant amounts of fill are needed; the ground must be capable of supporting the impact imposed by the drill rig and associated equipment. Clean fill or gravel can be brought in to cover areas with surface contamination.

Before drilling equipment is mobilized to the drilling pad, the travel route shall be surveyed for overhead and terrain hazards. Access roads shall be designed, constructed, and maintained to safely accommodate the movement of the drill rig and other equipment.

Material Safety Data Sheets (MSDSs) shall be available for all drilling fluids, grout, bentonite, or other substances used in the drilling process.

C. Drill Rig Requirements

All self-propelled drill rigs shall be equipped with the following safety features:

- Seatbelts,
- Multipurpose dry chemical fire extinguisher rated at not less that 2A:10B:C
- Multidirectional alarm
- Operator's Manual
- Horn
- Lights
- Other warning devices specified by the manufacturer

Self-propelled off-road drill rigs will be equipped with roll-over protective structures (ROPS) meeting Society of Automotive Engineers requirements.

The drilling equipment shall be equipped with two easily accessible emergency shutdown devices.

Control levers on the drill rig shall be clearly labeled indicating the function and direction of the movement.

All machine guards shall be in place while the rig is in operation.

Where drill rigs are equipped with a platform, the platform shall be constructed from material strong enough to support the weight of the load that will be placed on the platform. The platforms shall be accessed using a ladder or steps. Platforms over 6 feet above ground surface shall be equipped with a guardrail system that includes a toeboard.

The drill rig and associated equipment shall be inspected each day before use by a qualified mechanic or an operator knowledgeable of the specific equipment. Inspections and tests will be conducted in accordance with the manufacturer's recommendations. A written record of the inspections shall be kept on the equipment or in a project file. Consideration shall be given to the following items in the performance of equipment inspections.

- Missing nuts, bolts, pins, loose fittings and couplings.
- Cracked paint, frayed cables and hoses, evidence of fluid leakage on equipment or ground, and loose tracks and pads.
- Fluid levels in the battery, hydraulic system, brake system, and cooling systems; engine lubrication; and fuel supply. CAUTION: Never use your hands to check for hydraulic leaks. An open flame shall not be used to check fluid levels or look for leaks.
- Condition of glass in cab clean and not broken, gauges checked for proper function and readings; test of brake lights, horn, backup alarm, steering, and other controls.
- All emergency shutdown and warning systems to ensure that they are working correctly.

When deficiencies that affect the safe operation of equipment are identified, the equipment will be immediately taken out of service until unsafe conditions are corrected. A "DO NOT OPERATE" tag indicating that the equipment is not to be operated will be placed on the operator controls. When required or necessary, lockout procedures will be used. When corrections are made, the equipment will be re-tested for safe use before being returned to service.

D. Equipment Travel and Set-up

Safe clearances from overhead electrical transmission lines shall be maintained.

The operator shall ensure ground is stable and that grades, especially side traverses, are within the operating limits of the vehicle.

The mast shall be lowered and rig placed in appropriate configuration for travel. Drilling equipment shall not be transported for even a short distance with the mast up.

The drill rig must be leveled and stabilized with leveling jacks. Cribbing shall be used as necessary. Outriggers shall be extended per the manufacturer's specifications. Cribbing materials should be made from materials that are capable of supporting the weight of the rig. Care should be taken in muddy, soggy soils, or partially frozen areas. In addition to cribbing, guy wires should be used as required by the manufacturer to improve stability if the rig is located on wet, partially frozen ground, or in areas with loose, caving soil, or in an area subject to frequent gusty winds.

Prior to raising the mast (derrick) the operator shall look up for overhead obstructions. The drill rig operator shall verify that all personnel are cleared from the area immediately to the rear and the side of the mast.

Unsecured equipment shall be removed from the mast and cables; mud lines and cat line rope must be secured before raising the mast.

Before starting drill operations, the mast shall be secured and locked in accordance with the manufacturer's recommendations.

E. Equipment Operation

The drill rig shall be provided with a "kill" switch that, when activated, will shut down the rig. The switch should be clearly identified and tested daily to confirm operational status. All drilling crew members should be made aware of the location and purpose of this switch.

The rope, wire rope, or cable on the drill rig should never be wrapped around any part of the body.

The drill rig should not be operated during severe inclement weather, such as lightning storms, high winds, or severe rain. The mast should be lowered during these conditions.

Before starting, the operator shall verify that all gear boxes are in neutral; all hoist levers are disengaged; hydraulic levers are in the correct non-actuating positions; and the cathead rope is not on the cathead.

The operator shall verbally alert workers and visually verify that workers are clear from the dangerous parts of equipment before starting the equipment.

Drill crew members shall not wear loose clothing or clothing with loose ends, straps, drawstrings, belts, or otherwise unfastened parts that might catch on rotating or translating components of the drill rig. Rings and jewelry shall not be worn during a work shift.

The drill rig shall always be operated from the control panel. The operator must never leave the control panel while the drill is in operation. Only one person should operate the machine. If the operator must leave the area of the controls, the operator must shift the transmission controlling the rotary drive into neutral and place the feed control level in neutral. The drill rig shall be shut down before he operator leaves the vicinity of the drill.

Pressurized lines, such as airlines, mud hose, etc. shall be equipped with safety-type couplings and secured with wire or chain at each coupling to prevent whipping in the event of failure. Lines and safety connection shall be inspected daily. Pressurized lines shall not be disconnected until shut off and bled to reduce the pressure.

Drilling fluid discharges shall be channeled away from the work area to prevent the accumulation of water. Mud pits and drainage channels should be safely sloped and located to provide minimum interference with the work. Where necessary, suitable barricades or temporary fencing should be provided to protect the work area and reduce the possibility of injury to persons.

Where compressed air drilling is conducted, the exhaust shall be directed into an approved dust collection system. The cuttings shall be directed to the side away from employees. Workers shall be required to use protective clothing and respiratory protection, when required.

1. Tool Handling – Hoist Line

All wire ropes and rigging hardware shall be thoroughly inspected before use. Defective equipment shall not be used. Shop fabricated rigging or hooks without latches are not permitted. Where a chain sling is used, it shall be an alloy chain and shall be properly labeled.

Hoist and rigging hardware shall be used only for their designated intent and shall not be loaded beyond their rated capacity. Steps shall be taken to prevent two-blocking of hoist.

The tool handling hoist shall only be used for vertical lifting of tools. The tool hoist must not be used to pull on objects away from the drill rig, unless specifically designed for that purpose.

Drill rods shall be neither run nor rotated through rod slipping devices: no more than 1 foot of drill column shall be hoisted above the top of the drill mast. Drill rod joints shall not be made up, tightened, or loosened while a rod-slipping device supports the rod column.

Chuck jaws shall not be used to brake a string of drill rods while being lowered into the hole. A cat line or hoisting cable or plug should be used for braking before tightening the chuck.

- Drilling rods shall not be lowered into the hole with a pipe wrench.

- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tool directly to the feed mechanism of the drill. Do this only when the rope is secured with a wrench or dog collar. Do not use hydraulic leveling jacks for added pull to the hoist line or feed mechanism of the drill.

Loads shall not be hoisted over the head, body, or feet of any person. Loads shall not be left suspended when the hoist is unattended. Work is not permitted under a suspended load.

Hoist lines shall not be used to ride up the mast of a drill rig.

When wire rope hoist lines are used, the following precautions shall be followed:

- Wire rope must be properly matched with each sheave. (If too large, the rope will pinch; if too small, the sheave will groove. Once a sheave is grooved, it will pinch and damage the larger rope.)

- Most sheaves on rigs are stationary and designed for a single-part line. Never increase the number of sheaves, winch lines, or part lines unless approved by the drill manufacturer.

- Minimize the shock to wire rope. Pull loads smoothly and steadily, especially in cold weather. Never use frozen ropes.

- Protect wire rope from sharp corners and edges. Replace faulty guides and rollers.

- When handling wire rope, always wear gloves. Do not guide rope onto hoist drums with your hands. Replace the wire rope according to manufacturer's specifications. When new rope is installed, first lift a light load to allow the rope to adjust.

2. Auger Drilling

Use an auger guide to facilitate the starting of a straight hole through hard ground or pavement, as applicable. Apply an adequate amount of down pressure before rotation to seat the auger head below the ground surface.

The operator and tool handler shall establish a system of responsibility for the series of activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing auger fork.

The operator shall verify that the tool handler and others are clear from the auger column and that the auger fork is removed before starting rotation.

The manufacturer's recommendations must be followed for securing the auger to the power coupling. Workers shall not touch the coupling or the auger with their hands, a wrench, or any other tools during rotation.

Only tight-fitting pins designed for the auger shall be used to secure auger flights. The use of mismatched augers shall be avoided.

Augers shall be cleaned only when the rotating mechanism is in neutral and the auger stopped. Long-handled shovels may be used to move auger cuttings away from the auger.

Workers shall not place their hands or fingers under the bottom of auger section when hoisting the auger over the top auger section in the ground or over hard surfaces such as drill rig platform.

Workers shall, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.

3. Cathead Operations

The cathead shall be inspected before use. Inspection shall be made with the engine off. The cathead shall be kept clean and free of rust, oil, and grease. When 1/8-inch or greater rope groves form, the cathead should be replaced. In wet or icy conditions, a cathead cannot be used.

Always use a clean, dry rope. An oily rope may grab on the cathead. Never use a rope that is longer than necessary.

If the rope grabs or tangles, alert personnel to back away and stay clear. If tools are suspended, carefully shutdown the drill and back away. Once you have resolved the situation, the drill may be restarted and the tools lowered to safety.

Hoist lines shall be positioned to prevent contact with the cathead rope.

The following precautions shall be used to prevent cathead incidents:

- The operator should be on a level surface with firm footing.
- Do not wear loose clothing or gloves with loose straps or cuffs.
- Never wrap the rope around your hand, wrist, arm or other body parts. Never stand on the end of the cathead rope.
- Maintain a distance of 18 inches clearance between operating hand and drum.
- Be aware, the rope advances with each hammer blow.
- Do not leave a cathead unattended with the rope wrapped on the drum.

4. Rotary and Core Drilling

Water swivels, hoist plugs, rod chuck jaws etc. shall be inspected before use. Defective equipment shall not be used.

Only the operator of the drill rig shall brake or set a manual chuck so that rotation of the chuck will not occur before removing the wrench from the chuck.

Chuck jaws shall not be used to brake drill rods while lowering rods into hole. Drill rods shall not be held or lowered into the hole with pipe wrenches. If a string of drill rods are accidentally or inadvertently released into the hole, no attempt shall be made to grab the falling rods with hands or a wrench.

When drill rods are hoisted from the hole, they shall be cleaned to facilitate safe handling. The hand should not be used to clean drilling fluids from drill rods.

Drill rods shall never be lifted and leaned unsecured against the mast. Drill rods shall be secured to the upper ends of the drill rod sections for safe vertical storage or shall be laid horizontally.

In the event of a plugged bit or other circulation blockage, the pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.

The spinning chain is very powerful and must be treated with respect. Spinning chains must have a rope tail. Communication between the driller and tool handler is required for safe operation of the spinning chain.

If freezing weather is expected, all air and water lines should be drained when not in use.

F. Drill Rig Maintenance

Components found to be in defective condition, either during inspections or during rig operation, should be repaired immediately.

Rig maintenance shall only be performed after appropriate lockout/tagout procedures have been implemented.

The cathead should be kept clean and free of rust, oil, and grease. The cathead should be cleaned with a wire brush if it becomes rusty.

Drilling operations may require repair or disentanglement of wire rope on the mast while it is raised. Fall protection shall be used when personnel are exposed to a fall of 6 feet or greater.

Augers should be cleaned only when the drill rig is in neutral and the augers have stopped rotating. Hands or feet should not be used to move cuttings away from the auger.

G. Self-Assessment Checklist

The *ES&H Self-Assessment Checklist – Drilling* provides a method of verifying compliance with established regulations, safe work practices, and industry standards pertaining to drilling operations. The MWH ES&H Representative or ES&H staff may use this checklist when MWH employees and/or MWH Subcontractors are performing drilling operations or are exposed to the hazards of activities involving drilling.

VII. ATTACHMENTS

Attachment A: *Subcontractor Safety Program Criteria – Drilling Operations*
Attachment B: *ES&H Self-Assessment Checklist – Drilling Operations*

This page was intentionally left blank.

Drilling Operations
ES&H Procedure – 811
Attachment A

Subcontractor Safety Program Criteria – Drilling Operations

ATTACHMENT A

Subcontractor Safety Program Criteria – Drilling Operations

The following criteria are not intended to be all-inclusive, but are provided as a tool to facilitate review of subcontractor safety procedures. Subcontractors are expected to address the following items, at a minimum, in their safety procedures.

Minimum Acceptable Criteria for Subcontractor Drilling Safety Procedures:

1. Provide name and qualifications of the drilling "competent person" responsible for drilling (years and type of experience, training background, etc.).
2. Describe drill rig and equipment inspection criteria or procedures (frequency of inspections, visual vs. written inspections, items that are inspected).
3. Describe methods of identifying underground utilities (contacting utility companies, detection equipment).
4. Describe methods of avoiding contact with overhead power lines (de-energizing and grounding, insulating, safe clearance distances).
5. Describe methods to identify hazardous atmospheres and controls used to eliminate (detection equipment and controls).
6. Describe leveling and stabilizing methods for drill rig (drilling pad, jacks, cribbing, guy wires).
7. Verify that rig equipment is in good operational condition (including "kill" switch, cathead, ropes, pressurized hoses and lines, operator controls, machine guards, and drilling tools).
8. Describe procedures for operating in inclement weather, including lightning, high winds, and severe rain storms.
9. Describe other safe work practices for equipment operation (drill rig, equipment, tools, rig transportation, rig travel).
10. Describe on-the-job maintenance procedures, including lockout/tagout.
11. Describe safe work practices for other activities to be performed during this project (use of ladders, fall protection, electrical power tools, personal protective equipment, etc.).
12. Describe methods for disposal of non-hazardous drill cuttings and purge water (including accumulation, transport, and disposal).
13. If hazardous waste project, provide documentation of hazardous waste worker training and medical surveillance records for all project personnel (40-hour or 24-hour training, 8-hour refresher training) and describe methods of hazardous waste management (including accumulation, transport, and disposal).
14. Submit a copy of drilling license/certification and drill rig permit.
15. Describe methods and responsibilities for submittal of notifications and logs.
16. Complete the Waste Subcontractor Qualification form for each proposed transport and disposal facility.
17. Describe procedures for drilling site cleanup upon job completion.

<u>If drilling in areas with known or potential Ordance Explosives (OE)/Unexploded Ordnance (UXO) hazards:</u>

18. Provide documentation of UXO qualifications, hazardous waste worker training, and medical surveillance records for all project personnel (40-hour or 24-hour training, 8-hour refresher training).
19. Describe procedures for OE avoidance, identification and marking the boundaries of a clear approach path and work site for the sampling crews, vehicles, and equipment to enter the site.
20. Describe the procedures for drilling and monitoring and the process for encountered OE.

Drilling Operations
ES&H Procedure – 811
Attachment B

ES&H Self-Assessment Checklist – Drilling Operations

MWH

ATTACHMENT B

Self-Assessment Checklist – Drilling Operations

This checklist shall be used by MWH personnel only and may be completed at the frequency specified in the Project HASP or by the ES&H Representative.

This checklist is to be used at locations where (1) MWH employees and/or (2) MWH subcontractors are working on projects involving drilling operations.

During evaluation of MWH subcontractors, the ES&H Representative may consult with subcontractors when completing this checklist, but shall not direct the means and methods of operations nor direct the details of corrective actions unless provided for by contract requirements. Subcontractors shall determine how to correct deficiencies.

If deficiencies are identified that are considered imminent danger (possibility of serious injury or death) hazards, they shall be corrected immediately or all exposed MWH and MWH subcontract personnel shall be removed from the hazard until corrected.

Completed checklists shall be maintained in project ES&H Files.

Project Name: ______________________________ Project No.:_____________

Location: ______________________________ PM: ______________________

Evaluator: ____________________ Title: ________________ Date: __________

This specific checklist has been completed to:

☐ Evaluate MWH employee compliance with requirements

☐ Evaluate an MWH subcontractor's compliance with requirements

Check "Yes" if an assessment item is complete/correct.

Check "No" if an item is incomplete/deficient, section 2 must be completed for all items checked "No."

Subcontractor deficiencies shall be brought to the immediate attention of the subcontractor.

Check "N/A" if an item is not applicable
Check "N/O" if an item is applicable, but was not observed during the assessment

ATTACHMENT B

Self-Assessment Checklist – Drilling Operations

	Yes	No	N/A	N/O
Section 1				
SAFE WORK PRACTICES				
1. Only authorized, licensed operators meeting local requirements.	☐	☐	☐	☐
2. Spotters used for equipment in constricted areas.	☐	☐	☐	☐
3. Drill site work area demarcation in place.	☐	☐	☐	☐
4. Personnel cleared during rig startup.	☐	☐	☐	☐
5. Personnel clear of rotating parts.	☐	☐	☐	☐
6. Personnel not positioned under hoisted loads.	☐	☐	☐	☐
7. Augers and drill strings stored properly.	☐	☐	☐	☐
8. Good Housekeeping maintained on rig and work site.	☐	☐	☐	☐
9. Loose clothing and jewelry removed.	☐	☐	☐	☐
10. Smoking is prohibited around drilling operation.	☐	☐	☐	☐
11. Personnel wearing appropriate personal protective equipment (PPE).	☐	☐	☐	☐
12. Daily safety meeting completed.	☐	☐	☐	☐
13. Traffic control in place, where required.	☐	☐	☐	☐
Site Preparation				
14. Underground utilities & structures identified.	☐	☐	☐	☐
15. Drill site prepared for rig.	☐	☐	☐	☐
16. Travel routes surveyed for obstruction.	☐	☐	☐	☐
17. Required MSDSs on site.	☐	☐	☐	☐
Drill Rig Requirements				
18. Drill rig equipped with emergency stop controls.	☐	☐	☐	☐
19. Drill rig inspected daily, deficiencies corrected.	☐	☐	☐	☐
20. All machine guards are in place.	☐	☐	☐	☐
21. Platforms are properly constructed and accessible.	☐	☐	☐	☐
Equipment Travel and Set-up				
22. Safe clearance from overhead electrical maintained.	☐	☐	☐	☐
23. Mast lowered and equipment secure during travel.	☐	☐	☐	☐
24. Drill rig level and stabilized, proper cribbing used.	☐	☐	☐	☐
25. Mast secured before drilling.	☐	☐	☐	☐
Equipment Operation				
26. Personnel remain clear of cables and ropes.	☐	☐	☐	☐
27. Drilling operations suspended in inclement weather.	☐	☐	☐	☐
28. All gearboxes in neutral before starting.	☐	☐	☐	☐
29. Drill rig is always operated from control panel. Operator never leaves control panel while drill is in operation.	☐	☐	☐	☐
30. Pressurized lines are equipped with safety cables.	☐	☐	☐	☐
31. Drilling discharges channeled away from work area.	☐	☐	☐	☐
32. Compressed-air exhaust is controlled.	☐	☐	☐	☐
33. Wire ropes are inspected before use.	☐	☐	☐	☐
34. Hoist and hardware used only for designed purpose.	☐	☐	☐	☐
35. No more than one foot of drill column hoisted above mast.	☐	☐	☐	☐
36. Chuck jaws are not used as drill rod brake.	☐	☐	☐	☐
37. Wire ropes are properly matched to sleeves and are protected from sharp edges.	☐	☐	☐	☐
38. Operators are not guiding wire ropes with hands.	☐	☐	☐	☐
39. Auger guides are used to start auger in hard surfaces.	☐	☐	☐	☐

ATTACHMENT B

Self-Assessment Checklist – Drilling Operations

	Yes	No	N/A	N/O
40. Operator and tool handler have established responsibilities.	☐	☐	☐	☐
41. Augers are attached to power coupling per Manufacturer's instructions.	☐	☐	☐	☐
42. Auger flights are connected only by pins designed for such use.	☐	☐	☐	☐
43. Workers remain clear of auger and other rotating parts.	☐	☐	☐	☐
44. Cathead inspected before use.	☐	☐	☐	☐
45. Clean dry rope is used on cathead.	☐	☐	☐	☐
46. Proper actions are followed for cathead operations.	☐	☐	☐	☐
47. Drill rods are not leaned unsecured against mast.	☐	☐	☐	☐
48. Prior to disconnection plugged core drill rods, pressure source is isolated and pressure is bled off.	☐	☐	☐	☐
Drill Rig Maintenance				
49. Defects identified during inspection or operation are corrected before continuing operation.	☐	☐	☐	☐
50. Fall protection is used while climbing mast and for other unprotected elevated work.	☐	☐	☐	☐
51. Augers are cleaned only when drill is in neutral and auger has stopped.	☐	☐	☐	☐

ATTACHMENT B

Self-Assessment Checklist – Drilling Operations

SECTION 2

Complete this section for all items checked "No" in Sections 1. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Evaluator:________________________ Project Manager:____________________________

This page was intentionally left blank.

Appendix J
MSDSs

This page was intentionally left blank.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Alconox Detergent
Catalog Number: 2088000

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00901
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Surfactants
Hazard: No effects anticipated.
Date of MSDS Preparation:
Day: 11
Month: December
Year: 2001

2. COMPOSITION / INFORMATION ON INGREDIENTS

Alkyl aryl sulphonates, lauryl alcohol sulfates, phosphates and carbonates
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: 100.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: White powder
Odor: None

HMIS:
Health: 0
Flammability: 0
Reactivity: 0

Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: No effects are anticipated
Skin Contact: No effects are anticipated
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: None reported
Target Organs: None reported
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Flush eyes with water.
Skin Contact (First Aid): Wash skin with plenty of water.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not determined
Hazardous Combustion Products: None reported
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:

Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Sweep up material. Place material in a plastic bag. Mark bag 'Non-hazardous trash', and dispose of as normal refuse. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: Not applicable
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: White powder
Physical State: Solid
Molecular Weight: Not applicable
Odor: None
pH: Not determined
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
Boiling Point: Not applicable
Melting Point: Not determined
Specific Gravity (water = 1): Not determined
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Soluble
Acid: Not determined
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Excess moisture
Reactivity / Incompatibility: None reported
Hazardous Decomposition: Heating to decomposition releases toxic fumes of carbon monoxide and carbon dioxide.
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: --
No toxicological data available for the ingredients of this product.

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Place material in a plastic bag. Mark bag 'Non-hazardous trash', and dispose of as normal refuse.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA

I.M.O.:

I.M.O. Proper Shipping Name: Not Currently Regulated

--

I.M.O. Hazard Class: NA

I.M.O. Subsidiary Risk: NA

I.M.O. ID Number: NA

I.M.O. Packing Group: NA

Additional Information: This product may be shipped as part of a chemical kit composed of various compatible dangerous goods for analytical or testing purposes. This kit would have the following classification: Proper Shipping Name: Chemical Kit Hazard Class: 9 UN Number 3316.

---

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product does not meet the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): This product is not hazardous under 29 CFR.1910.1200 and therefore is not covered by Title III under SARA.

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Not applicable

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Not applicable

RCRA: Contains no RCRA regulated substances.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): None

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

---

16. OTHER INFORMATION

Intended Use: Surfactant

References: Vendor Information. Technical Judgment.

Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

HACH COMPANY ©2007

GFS CHEMICALS, INC.
P.O. Box 245 Powell, OH 43065
740-881-5501(Tel.) 740-881-5989(Fax)
1-800-424-9300(Chemtrec 24Hr. Info.)

MATERIAL SAFETY DATA SHEET

2174

CONDUCTIVITY STANDARD SOLUTION

CHEMICAL NAME & SYNONYMS	DOT CLASS	SARA TITLE 313
Conductivity Standard Solution	NR	No
Potassium Chloride, Solution	**TSCA listed** - Yes	

FORMULA	REPORTABLE QUANTITY	F.W.	CAS#
KCl <5% - Not a hazardous material.	N/A	74.55	7447-40-7
H_2O >95%	N/A	18.02	7732-18-5

PHYSICAL DATA
Boiling point 100°C; Density 1.0; Conductivity @25°C 1,413 uS/cm (uMHO). Completely miscible with water.

APPEARANCE & ODOR
Clear, colorless solution. Odorless.

REACTIVITY & CONDITIONS TO AVOID
None.

FIRE HAZARDS
None.

EXTINGUISHER	FLASHPOINT	LEL	UEL
Fight surrounding fire.	N/A	N/A	N/A

HEALTH HAZARDS
Toxicity of this solution is very low (this is a very weak salt solution). Any salt solution may be irritating to eyes and mucous membranes. LD/TD: not found. OSHA PEL/ACGIH TLV not established. Not considered to be a carcinogen.

SPECIAL PRECAUTIONS
Always use good laboratory practices.

FIRST AID
Wash with water. If irritation develops, get medical attention.

SPILLS & LEAKS
Wash up with water. Disposal to sanitary drain.

CATALOG #	PREPARED BY	DATE
2174	MDM	April 1, 2004

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Ferrous Iron Reagent
Catalog Number: 2514025

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00024
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: May cause irritation.
Date of MSDS Preparation:
Day: 05
Month: October
Year: 2007

2. COMPOSITION / INFORMATION ON INGREDIENTS

1, 10-Phenanthroline
CAS No.: 5144-89-8
TSCA CAS Number: 66-71-7
Percent Range: 1.0 - 10.0
Percent Range Units: weight / weight
LD50: Oral Rat LD_{50} = 132 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Sodium Bicarbonate
CAS No.: 144-55-8
TSCA CAS Number: 144-55-8
Percent Range: 90.0 - 100.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 4220 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: White powder
Odor: Not determined
MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION

HMIS:
Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 1
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: None reported
Target Organs: None reported
Ingestion: Very large doses may cause: abdominal pain gastrointestinal disturbances alkalosis which causes abnormally high alkali reserve of the blood and other body fluids hypotension
Target Organs: None reported
Inhalation: May cause: respiratory tract irritation
Target Organs: None reported
Medical Conditions Aggravated: Pre-existing: Kidney conditions
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with soap and plenty of water. Call physician if irritation develops.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: Remove to fresh air.

5. FIRE FIGHTING MEASURES

Flammable Properties: Does not burn, but may melt in a fire, releasing toxic fumes.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable

Hazardous Combustion Products: Toxic fumes of: sodium monoxide nitrogen oxides. carbon monoxide, carbon dioxide.
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Water. Carbon dioxide Dry chemical.
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

---

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Scoop up spilled material into a large beaker and dissolve with water. Flush the spilled material to the drain with a large excess of water. Decontaminate the area of the spill with a weak acid solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

---

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin Do not breathe dust. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Keep container tightly closed when not in use. Protect from: moisture oxidizers
Flammability Class: Not applicable

---

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin Do not breathe: dust Wash thoroughly after handling. Keep away from: oxidizers
TLV: Not established
PEL: Not established

---

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: White powder
Physical State: Solid
Molecular Weight: Not applicable
Odor: Not determined
pH: Not determined
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable

Boiling Point: Not applicable
Melting Point: Not determined
Specific Gravity (water = 1): 2.10
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Slightly soluble
Acid: Slightly soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Excess moisture Heating to decomposition.
Reactivity / Incompatibility: Incompatible with: oxidizers
Hazardous Decomposition: Toxic fumes of: nitrogen oxides sodium oxides carbon monoxide carbon dioxide
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: Sodium Bicarbonate: Eye - rabbit - 100 mg/30 seconds - MILD; Skin - Human - 30 mg/3 days intermittent - MILD
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Sodium Bicarbonate: Oral rat LD_{50} = 4220 mg/kg; 1, 10-Phenanthroline: Oral rat LD_{50} = 132 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Dilute material with excess water making a weaker than 5% solution. Open cold water tap completely, slowly pour the material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:

D.O.T. Proper Shipping Name: Not Currently Regulated

--

DOT Hazard Class: NA

DOT Subsidiary Risk: NA

DOT ID Number: NA

DOT Packing Group: NA

I.C.A.O.:

I.C.A.O. Proper Shipping Name: Not Currently Regulated

--

ICAO Hazard Class: NA

ICAO Subsidiary Risk: NA

ICAO ID Number: NA

ICAO Packing Group: NA

I.M.O.:

I.M.O. Proper Shipping Name: Not Currently Regulated

--

I.M.O. Hazard Class: NA

I.M.O. Subsidiary Risk: NA

I.M.O. ID Number: NA

I.M.O. Packing Group: NA

Additional Information: This product may be shipped as part of a chemical kit composed of various compatible dangerous goods for analytical or testing purposes. This kit would have the following classification: Proper Shipping Name: Chemical Kit Hazard Class: 9 UN Number 3316. ALSO NOTE: If the National Competent Authority declares this product an environmental hazard by Special Provision 909 (IMDG) and Special Provision A97 (IATA) the classification may be UN3077 or UN3082.

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Not applicable

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Not applicable

RCRA: Contains no RCRA regulated substances.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): None

California Perchlorate Rule CCR Title 22 Chap 33:

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Iron determination
References: TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). In-house information. Technical Judgment. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991.
Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

HACH COMPANY ©2008

This page was intentionally left blank.

Procter & Gamble
Fabric and Home Care Division
Ivorydale Technical Center
5299 Spring Grove Avenue
Cincinnati, OH 45217-1087

MATERIAL SAFETY DATA SHEET

MSDS #: LDL 0001 Issue Date: 09/28/00
Supersedes: LDL9901 Issue Date: 02/17/99

SECTION I - CHEMICAL PRODUCT

Identity: **Liquid Hand Dishwashing Detergents**

Brands:

DAWN (All Variations)

IVORY (All Variations)

JOY (All Variations)

Hazard Rating:			
	Health:	2	4=EXTREME
	Flammability:	1	3=HIGH
	Reactivity:	0	2= MODERATE
			1=SLIGHT

Emergency Telephone Number: 24hr P&G Operator:

DAWN - 1-800-725-3296 (DAWN)

IVORY 1-800-253-2753 (IVORY)

JOY - 1-800-436-1569 (JOY)

or call Local Poison Control Center or your physician

SECTION II - COMPOSITION AND INGREDIENTS

Ingredients/Chemical Name: Cleaning and sudsing agents (anionic and nonionic surfactants), dispensing aid (ethyl alcohol), water, stabilizing agents, colorant and perfume.

Dawn and Joy Antibacterial Hand Soaps also contain the antibacterial active Triclosan.
Dawn Hand Care product contains a protease enzyme.

Hazardous Ingredients as defined by OSHA, 29 CFR 1910.1200.

Chemical Name	Common Name	CAS No.	Recommended Limits	Composition Range	LD50/LC50
Ethyl alcohol	Ethanol	64-17-5	ACGIH TLV: 1880 mg/m^3	5-10%	N/A
Subtilisin	Protease	9014-01-1	NIIOSH STEL 0.00006 mg/m^3	<0.01%	N/A

SECTION III - HAZARDS IDENTIFICATION

Health Hazards (Acute and Chronic):

Ingestions:	Ingestion may cause transient gastrointestinal irritation.
Eye Contact:	May cause mild, transient irritation.
Skin:	Transient irritation with prolonged exposure to concentrated material.

Signs and Symptoms of Exposure:

Ingestion:	May result in nausea, vomiting, and/or diarrhea.
Eye Contact:	May cause stinging, tearing, itching, swelling, and/or redness.
Skin:	Prolonged contact with concentrated material may be drying or transiently irritating to skin.

SECTION IV - FIRST AID INFORMATION

Emergency and First Aid Procedures:

Ingestion:	Drink 1 or 2 glasses of water.
Eye Contact:	Flush thoroughly with water for 15 minutes.
Skin:	If prolonged contact occurs, rinse thoroughly with water. If spilled on clothing, change clothes. If symptoms persist or recur, seek medical attention.

Other: Consumer product package has a voluntary avoid accidents statement.

SECTION V - FIRE FIGHTING INFORMATION

Flash Point (Method Used): 105-130°F. Pensky-Martens (Closed cup)

Explosive Limits: *LEL:* N/A *UEL*: N/A

Extinguishing Media: CO_2, water or dry chemical.

Special Fire Fighting Procedures: None. Although this product has a flash point below 200°F (closed cup), it is an aqueous solution containing ethyl alcohol which does not sustain combustion.

Unusual Fire Hazards: None

Stability *Unstable*: *Conditions to Avoid*: None known

Stable: X

Incompatibility (Materials to Avoid): None known

Hazardous Decomposition/By Products: None known

Hazardous Polymerization: *May Occur*: *Conditions to Avoid*: None known

Will Not Occur: X

SECTION VI - ACCIDENTAL RELEASE MEASURES

Personal Precautions: None

Environmental Precautions: DISPOSAL IS TO BE PERFORMED IN COMPLIANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS. **Ultra Dawn, Ultra Joy and Ultra Ivory undiluted waste products are considered RCRA Ignitable.**

Solutions of the Ultra Dawn, Ultra Ivory or Ultra Joy liquid hand dishwashing detergents, diluted in the course of use, may be allowed to be flushed down sewer. First check with your local water treatment plant. Recycling is recommended for undiluted scrap product. Do not landfill.

Steps To Be Taken in Case Material is Released or Spilled: Prevent spills from reaching a waterway. Sorbents may be used. Read “Waste Disposal Method” below for further information.

SECTION VII - HANDLING AND STORAGE

Precautions To Be Taken in Handling and Storing: No unusual precautions necessary.

Other Precautions: None known

SECTION VIII - EXPOSURE CONTROLS, PERSONAL PROTECTION

Respiratory Protection (Specify Type): None required with normal use.

Ventilation *Local Exhaust*: None required with normal consumer use. *Special*: None

Mechanical (General): Normal/general dilution ventilation is acceptable. *Other*: None

Eye Protection: None required with normal consumer use.

Industrial Setting: For splash protection, use chemical goggles. Eye Wash fountain is desirable.

Protective Gloves: None required with normal use.

Industrial Setting: Protective gloves (rubber, neoprene) should be used for prolonged direct contact.

Other Protective Equipment: None required with normal use.

SECTION IX - PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point °F: Not known	**Specific Gravity (H_2O=1)**: ca. 1
Vapor Pressure (mm Hg): N/A	**Percent Volatile by Volume (%)**: ~60-65%
Vapor Density (Air=1): N/A	**Evaporation Rate (nBuOAc=1)**: Unknown
Odor Threshold: N/A	**Freezing Point:** ~ 30 F
Coefficient of Water/Oil Distribution: N/A	**pH (1% solution):** ~ 8
Scooped Density: N/A	**Solubility in Water**: Completely
Appearance and Odor: Purple, Blue, Green, Yellow, Pink or Orange liquids. All products are perfumed.	**Reserve Alkalinity:** N/A

SECTION X - STABILITY AND REACTIVITY

Possible Hazardous Reactions/Conditions: None known

Conditions to Avoid: None

Materials to Avoid: None

Hazardous Decomposition Products: None known

Other Recommendations: None

SECTION XI - TOXICOLOGICAL INFORMATION

LD50 (rats oral): approx 12 mL/kg
ED50 approx 2.3 mL/kg
Liquid hand dishwashing detergents have a relatively low order of toxicity. They may be irritating, but they are not expected to be corrosive. They are expected to be emetic.

SECTION XII - ECOLOGICAL INFORMATION

All surfactants are readily biodegradable. These products are safe for septic tanks.

SECTION XIII - DISPOSAL CONSIDERATIONS

Waste Disposal Method: DISPOSAL IS TO BE PERFORMED IN COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS. RCRA hazardous under the classification "Ignitable." RCRA provides an exemption for household waste. Household product is safe for disposal down the drain during use or in the trash. *Industrial Setting*: Solutions of diluted detergent in the course of use, may be allowed to be flushed down sewer. First check with your local water treatment plant. Recycling is recommended for undiluted scrap product. **Hazardous waste incineration is necessary for the Ultra versions of these products if disposal is ultimately warranted**. Do not landfill.

SECTION XIV - TRANSPORT INFORMATION

Small household containers of Dawn, Joy and Ivory are not DOT regulated.

SECTION XV - ADDITIONAL REGULATORY INFORMATION

All components are listed on the US TSCA Inventory. No components are affected by Significant New Use Rules (SNURs) under TSCA §5.

No components of Dawn, Ivory or Joy are subject to California Proposition 65 labeling.

All ingredients are CEPA approved for import to Canada by Procter & Gamble only. This product has been classified with Hazard Criteria of the Canadian Control Products Regulation (CPR) and this MSDS contains all information required by the Canadian Products Regulation.

SECTION XVI - OTHER INFORMATION

*N/A. **-** Not Applicable *N/K. **-** Not Known

The submission of this MSDS may be required by law, but this is not an assertion that the substance is hazardous when used in accordance with proper safety practices and normal handling procedures. Data supplied is for use only in connection with occupational safety and health.

The information contained herein has been compiled from sources considered by Procter & Gamble to be dependable and is accurate to the best of the Company's knowledge. The information relates to the specific material designated herein, and does not relate to the use in combination with any other material or any other process. Procter & Gamble assumed no responsibility for injury to the recipient or third persons, for any damage to any property resulting from misuse of the controlled product.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Nitric Acid
Catalog Number: 15249

Hach Company	Emergency Telephone Numbers:
P.O.Box 389	(Medical and Transportation)
Loveland, CO USA 80539	(303) 623-5716 24 Hour Service
(970) 669-3050	(515)232-2533 8am - 4pm CST

MSDS Number: M00222
Chemical Name: Nitric acid
CAS No.: 7697-37-2
Chemical Formula: HNO_3
Chemical Family: Inorganic Acid
Hazard: Causes severe burns. Oxidizer.
Date of MSDS Preparation:
Day: 19
Month: March
Year: 2007

2. COMPOSITION / INFORMATION ON INGREDIENTS

<u>**Nitric Acid**</u>
CAS No.: 7697-37-2
TSCA CAS Number: 7697-37-2
Percent Range: 65.0 - 75.0
Percent Range Units: weight / weight
LD50: Oral human LDLo = 430 mg/kg.
LC50: Inhalation rat LC_{50} = 625 ppm/4hours.
TLV: 2 ppm
PEL: 2 ppm
Hazard: Causes severe burns. Oxidizer.

<u>**Demineralized Water**</u>
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: 25.0 - 35.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Faint yellow to colorless
Odor: Suffocating
MAY BE FATAL IF SWALLOWED OR INHALED CAUSES SEVERE BURNS

STRONG OXIDIZER: CONTACT WITH OTHER MATERIAL MAY BE EXPLOSIVE

HMIS:
Health: 3
Flammability: 1
Reactivity: 1
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 3
Flammability: 0
Reactivity: 0
Symbol: oxy
Potential Health Effects:
Eye Contact: Causes severe burns
Skin Contact: Causes severe burns
Skin Absorption: None reported
Target Organs: None reported
Ingestion: Causes: severe burns
Target Organs: None reported
Inhalation: Causes: severe burns May cause: bronchitis pneumonitis teeth erosion
Target Organs: None reported
Medical Conditions Aggravated: Pre-existing: Eye conditions Respiratory conditions Skin conditions
Chronic Effects: Chronic overexposure may cause erosion of the teeth
Cancer / Reproductive Toxicity Information:
O.S.H.A. Listed: No

IARC Listed: No

NTP Listed: No

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water for 15 minutes. Remove contaminated clothing. Call physician immediately.
Ingestion (First Aid): Do not induce vomiting. Give 1-2 glasses of water. Never give anything by mouth to an unconscious person. Call physician immediately.
Inhalation: Remove to fresh air. Give artificial respiration if necessary. Call physician.

5. FIRE FIGHTING MEASURES

Flammable Properties: Not Flammable, but reacts with most metals to form flammable hydrogen gas. Strong oxidizer. Contact with combustible materials may cause a fire or explosion.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable

Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: Toxic fumes of: nitrogen oxides.
Fire / Explosion Hazards: Contact with metals gives off hydrogen gas which is flammable May react violently with: combustible materials
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions Water spray to cool containers
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear. Evacuate area and fight fire from a safe distance.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Remove all combustible material from spill area. Absorb spilled liquid with non-reactive sorbent material. Stop spilled material from being released to the environment. Dike large spills to keep spilled material from entering sewage and drainage systems or bodies of water.
Clean-up Technique: Cover spilled material with an alkali, such as soda ash or sodium bicarbonate. Scoop up slurry into a large beaker. Dilute with a large excess of water. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Product is regulated as RCRA hazardous waste. Product is regulated as a hazardous water pollutant.
304 EHS RQ (40 CFR 355): Nitric Acid 1000 lbs.
D.O.T. Emergency Response Guide Number: 157

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin clothing Do not breathe mist or vapors. Use with adequate ventilation. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Store in a cool, dry place. Keep away from: combustible materials heat metals organic material
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Have a safety shower nearby. Use a fume hood to avoid exposure to dust, mist or vapor. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: neoprene latex gloves
Inhalation Protection: laboratory fume hood
Precautionary Measures: Avoid contact with: eyes skin clothing Do not breathe: mist/vapor Keep away from: alkalies metals organic materials other combustible materials oxidizable materials Wash thoroughly after handling.
TLV: 2 ppm
PEL: 2 ppm

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Faint yellow to colorless
Physical State: Liquid
Molecular Weight: 63.006
Odor: Suffocating
pH: <0.5
Vapor Pressure: 62 mm Hg @ 20°C
Vapor Density (air = 1): 2 - 3
Boiling Point: 122°C (251.6°F)
Melting Point: -34°C (-29.2°F)
Specific Gravity (water = 1): 1.41
Evaporation Rate (water = 1): Not determined
Volatile Organic Compounds Content: None
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Miscible
Acid: Miscible
Other: Not determined
Metal Corrosivity:
Steel: Corrosive
Aluminum: Corrosive

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Excess moisture
Reactivity / Incompatibility: May react violently in contact with: acids alkalies carbides hydrogen sulfide metals turpentine May explode in contact with: combustible materials
Hazardous Decomposition: Toxic fumes of: nitrogen oxides
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: Oral human LDLo = 430 mg/kg.
LC50: Inhalation rat LC_{50} = 625 ppm/4hours.
Dermal Toxicity Data: None reported.
Skin and Eye Irritation Data: None reported.
Mutation Data: None reported.
Reproductive Effects Data: Oral rat TDLo = 2345 mg/kg: biochemical and metabolic effects on newborn.
Ingredient Toxicological Data: Not applicable

12. ECOLOGICAL INFORMATION

Product Ecological Information: Shore crab LC50 = 180 mg/l/48H; Cockle LC50 = 330 - 1000 mg/l/48H; Starfish LC50 = 100-300 mg/l/48H

Ingredient Ecological Information: --
Not applicable

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: D002

Special Instructions (Disposal): Work in an approved fume hood. Working in a large container, cautiously add small portions of the material to cold water with agitation. Do not breathe the fumes. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Open cold water tap completely, slowly pour the reacted material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash. Rinsate from empty containers may contain sufficient product to require disposal as hazardous waste.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Nitric Acid
(70%)
DOT Hazard Class: 8
DOT Subsidiary Risk: NA
DOT ID Number: UN2031
DOT Packing Group: II
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Nitric Acid
(70%)
ICAO Hazard Class: 8
ICAO Subsidiary Risk: NA
ICAO ID Number: UN2031
ICAO Packing Group: II
I.M.O.:
I.M.O. Proper Shipping Name: Nitric Acid
(70%)
I.M.O. Hazard Class: 8
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: UN2031
I.M.O. Packing Group: II
Additional Information: This product may be shipped as part of a chemical kit composed of various compatible dangerous goods for analytical or testing purposes. This kit would have the following classification: Proper Shipping Name: Chemical Kit
Hazard Class: 9 UN Number 3316.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard Delayed (Chronic) Health Hazard Fire Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product contains a chemical(s) subject to the reporting requirements of Section 313 of Title III of SARA.
Nitric Acid
302 (EHS) TPQ (40 CFR 355): Nitric acid: 1000 lbs.
304 CERCLA RQ (40 CFR 302.4): Nitric acid: 1000 lbs.
304 EHS RQ (40 CFR 355): Nitric Acid 1000 lbs.
Clean Water Act (40 CFR 116.4): Nitric acid - RQ 1000 lbs.
RCRA: Contains RCRA regulated substances. See Section 13, EPA Waste ID Number.

C.P.S.C.: The label for this product bears the signal word "POISON" because the concentration of Nitric Acid in the product is greater than/equal to 5%.

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): None

California Perchlorate Rule CCR Title 22 Chap 33:

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: TSCA Listed: Yes

TSCA CAS Number: 7697-37-2

16. OTHER INFORMATION

Intended Use: Laboratory reagent

References: Vendor Information. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. The Merck Index, 11th Ed. Rahway, New Jersey: Merck and Co., Inc., 1989. NIOSH Registry of Toxic Effects of Chemical Substances, 1985-86. Cincinnati: U.S. Department of Health and Human Services, April, 1987. IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans. World Health Organization (Volumes 1-42) Supplement 7. France: 1987. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991. CCINFO RTECS. Canadian Centre for Occupational Health and Safety. Hamilton, Ontario Canada: 30 June 1993. 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor).

Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

HACH COMPANY ©2008

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: NitriVer ® 3 Nitrite Reagent
Catalog Number: 2107169

Hach Company	Emergency Telephone Numbers:
P.O.Box 389	(Medical and Transportation)
Loveland, CO USA 80539	(303) 623-5716 24 Hour Service
(970) 669-3050	(515)232-2533 8am - 4pm CST

MSDS Number: M00055
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Causes eye burns.
Date of MSDS Preparation:
Day: 24
Month: March
Year: 2007

2. COMPOSITION / INFORMATION ON INGREDIENTS

Chromatropic Acid, Disodium salt
CAS No.: 129-96-4
TSCA CAS Number: 129-96-4
Percent Range: 1.0 - 5.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 > 5000 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Sodium Sulfanilate
CAS No.: 515-74-2
TSCA CAS Number: 515-74-2
Percent Range: 5.0 - 15.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Toxic properties unknown. May cause irritation.

Potassium Pyrosulfate
CAS No.: 7790-62-7
TSCA CAS Number: 7790-62-7

Percent Range: 1.0 - 10.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 2340 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Causes eye burns.

Potassium Phosphate, Monobasic
CAS No.: 7778-77-0
TSCA CAS Number: 7778-77-0
Percent Range: 75.0 - 85.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 7100 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

1,2-Cyclohexanediaminetetraacetic Acid Trisodium Salt
CAS No.: 36679-96-6
TSCA CAS Number: 36679-96-6
Percent Range: 1.0 - 5.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Toxic properties unknown. May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: White powder
Odor: Not determined
CAUSES EYE BURNS MAY CAUSE SKIN AND RESPIRATORY TRACT IRRITATION

HMIS:
Health: 3
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 2
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: Causes eye burns.
Skin Contact: May cause irritiation
Skin Absorption: None reported
Target Organs: None reported

Ingestion: May cause: irritation of the mouth and esophagus Very large doses may cause: gastrointestinal disturbances cardiac depression kidney damage

Target Organs: Heart Kidneys

Inhalation: May cause: irritation of nose and throat

Target Organs: None reported

Medical Conditions Aggravated: Pre-existing: Eye conditions Kidney conditions Central nervous system diseases

Chronic Effects: None reported

Cancer / Reproductive Toxicity Information:

This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported

Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.

Skin Contact (First Aid): Wash skin with soap and plenty of water. Call physician if irritation develops.

Ingestion (First Aid): Do not induce vomiting. Give 1-2 glasses of water. Call physician immediately. Never give anything by mouth to an unconscious person.

Inhalation: Remove to fresh air. Give artificial respiration if necessary. Call physician.

5. FIRE FIGHTING MEASURES

Flammable Properties: During a fire, this product decomposes to form toxic gases.

Flash Point: Not applicable

Method: Not applicable

Flammability Limits:

Lower Explosion Limits: Not applicable

Upper Explosion Limits: Not applicable

Autoignition Temperature: Not applicable

Hazardous Combustion Products: Toxic fumes of: phosphorus oxides carbon monoxide, carbon dioxide.

Fire / Explosion Hazards: None reported

Static Discharge: None reported.

Mechanical Impact: None reported

Extinguishing Media: Use media appropriate to surrounding fire conditions

Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:

Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.

Containment Technique: Stop spilled material from being released to the environment.

Clean-up Technique: Scoop up spilled material into a large beaker and dissolve with water. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Flush the spilled material to the drain with a large excess of water.

Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled.

Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin Do not breathe dust. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Protect from: light heat moisture
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin Do not breathe: dust Wash thoroughly after handling. Protect from: light heat moisture
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: White powder
Physical State: Solid
Molecular Weight: Not applicable
Odor: Not determined
pH: of 5% solution = 3.2
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
Boiling Point: Not applicable
Melting Point: 224°C (435°F)
Specific Gravity (water = 1): 3.12
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Soluble
Acid: Not determined
Other: Not determined
Metal Corrosivity:
Steel: 0.057 in/yr
Aluminum: 0.00 in/yr

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Excess moisture Extreme temperatures
Reactivity / Incompatibility: None reported
Hazardous Decomposition: Toxic fumes of: phosphorus oxides carbon dioxide carbon monoxide
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Chromatropic Acid: Oral rat LD50: >5000 mg/kg, Potassium Phosphate Monobasic: Oral rat LD50 = 7100 mg/kg, Potassium Pyrosulfate: Oral rat LD50 = 2340 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Dilute material with excess water making a weaker than 5% solution. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Open cold water tap completely, slowly pour the reacted material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA

I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: This product may be shipped as part of a chemical kit composed of various compatible dangerous goods for analytical or testing purposes. This kit would have the following classification: Proper Shipping Name: Chemical Kit Hazard Class: 9 UN Number 3316.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33:
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: This product contains a chemical(s) exempt from the TSCA 8(b) Inventory due to a Low Volume Exemption held by Hach Company.
TSCA CAS Number: Not applicable
1,2-Cyclohexanediaminetetraacetic Acid Trisodium Salt. This chemical may only be used as a chelating reagent for chemical reactions.

16. OTHER INFORMATION

Intended Use: Determination of nitrite
References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991. In-house information. Technical Judgment. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992.
Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

HACH COMPANY ©2008

This page was intentionally left blank.

Material Safety Data Sheet

Nitrogen

Section 1. Chemical product and company identification

Product name	:	Nitrogen
Supplier	:	AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	:	Synthetic/Analytical chemistry. Liquid – cryogenic coolant.
Synonym	:	nitrogen (dot); nitrogen gas; Nitrogen NF, LIN, Cryogenic Liquid Nitrogen, Liquid Nitrogen
MSDS #	:	001040
Date of Preparation/Revision	:	**2/13/2009.**
In case of emergency	:	1-866-734-3438

Section 2. Hazards identification

Physical state : Gas. [NORMALLY A COLORLESS GAS: MAY BE A CLEAR COLORLESS LIQUID AT LOW TEMPERATURES. SOLD AS A COMPRESSED GAS OR LIQUID IN STEEL CYLINDERS.]

Emergency overview : WARNING!

GAS:
CONTENTS UNDER PRESURE.
Do not puncture or incinerate container.
Can cause rapid suffocation.
May cause severe frostbite.
LIQUID:
Extremely cold liquid and gas under pressure.
Can cause rapid suffocation.
May cause severe frostbite.

Do not puncture or incinerate container.

Contact with rapidly expanding gases or liquids can cause frostbite.

Routes of entry : Inhalation

Potential acute health effects

Eyes : Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns.

Skin : Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns.

Inhalation : Acts as a simple asphyxiant.

Ingestion : Ingestion is not a normal route of exposure for gases. Contact with cryogenic liquid can cause frostbite and cryogenic burns.

Potential chronic health effects : **CARCINOGENIC EFFECTS**: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.

Medical conditions aggravated by over-exposure : Acute or chronic respiratory conditions may be aggravated by overexposure to this gas.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Nitrogen	7727-37-9	100	Oxygen Depletion [Asphyxiant]

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product : Non-flammable.

Products of combustion : Decomposition products may include the following materials:
nitrogen oxides

Fire-fighting media and instructions : Use an extinguishing agent suitable for the surrounding fire.

Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up : Immediately contact emergency personnel. Stop leak if without risk. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling : High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cryogenic liquids. Prevent entrapment of liquid in closed systems or piping without pressure relief devices. Some materials may become brittle at low temperatures and will easily fracture.

Storage : Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).
For additional information concerning storage and handling refer to Compressed Gas Association pamphlets P-1 Safe Handling of Compressed Gases in Containers and P-12 Safe Handling of Cryogenic Liquids available from the Compressed Gas Association, Inc.

Section 8. Exposure controls/personal protection

Engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

When working with cryogenic liquids, wear a full face shield.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Insulated gloves suitable for low temperatures

Personal protection in case of a large spill : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name	
nitrogen	Oxygen Depletion [Asphyxiant]

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight : 28.02 g/mole

Molecular formula : N2

Boiling/condensation point : -195.8°C (-320.4°F)

Melting/freezing point : -210°C (-346°F)

Critical temperature : -146.9°C (-232.4°F)

Vapor density : 0.967 (Air = 1) Liquid Density@BP: 50.46 lb/ft3 (808.3 kg/m3)

Specific Volume (ft^3/lb) : 13.8889

Gas Density (lb/ft^3) : 0.072

Section 10. Stability and reactivity

Stability and reactivity : The product is stable.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Environmental fate : Not available.

Environmental hazards : No known significant effects or critical hazards.

Toxicity to the environment : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1066 UN1977	NITROGEN, COMPRESSED Nitrogen, refrigerated liquid	2.2	Not applicable (gas).		**Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 75 kg **Cargo aircraft** Quantity limitation: 150 kg
TDG Classification	UN1066 UN1977	NITROGEN, COMPRESSED Nitrogen, refrigerated liquid	2.2	Not applicable (gas).		**Explosive Limit and Limited Quantity Index** 0.125 **Passenger Carrying Road or Rail Index** 75

Nitrogen						
Mexico Classification	UN1066 UN1977	NITROGEN, COMPRESSED Nitrogen, refrigerated liquid	2.2	Not applicable (gas).		-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 15. Regulatory information

United States

U.S. Federal regulations : **United States inventory (TSCA 8b):** This material is listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: nitrogen
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: nitrogen: Sudden release of pressure

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 accidental release prevention: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

State regulations : **Connecticut Carcinogen Reporting:** This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is not listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

Canada

WHMIS (Canada) : Class A: Compressed gas.

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is not listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Nitrogen

Label requirements : GAS:
CONTENTS UNDER PRESURE.
Do not puncture or incinerate container.
Can cause rapid suffocation.
May cause severe frostbite.
LIQUID:
Extremely cold liquid and gas under pressure.
Can cause rapid suffocation.
May cause severe frostbite.

Canada

Label requirements : Class A: Compressed gas.

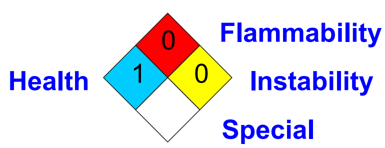
Hazardous Material Information System (U.S.A.) :

Health	1
Flammability	0
Physical hazards	0

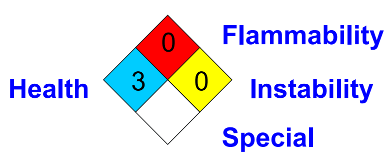
liquid:

Health	3
Fire hazard	0
Reactivity	0
Personal protection	

National Fire Protection Association (U.S.A.) :



liquid:



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet

June 1, 1999

YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387
USA

C-P# 05478-60

Information and Emergency Phone: (937) 767-7241

SECTION 1 - MATERIAL IDENTIFICATION

PRODUCT NAME: **YSI 3682 Zobell Solution** (ORP Cal. Solution) FORMULA: n/ap
Chemical Type: Inorganic chloride / cyanide
CAS No. n/app

SECTION 2 - HAZARDOUS / IMPORTANT INGREDIENTS

Chemical	CAS No.	PERCENT	PEL/TLV	CARCINOGEN (OSHA, NTP, IARC)
Potassium chloride	7447-40-7	72 - 78%	none	no
Potassium ferrocyanide, trihydrate	14459-95-1	10 - 15%	none	no
Potassium ferricyanide	13746-66-2	10 - 15%	none	no

SECTION 3 - CHEMICAL AND PHYSICAL PROPERTIES

Appearance: white powder
Odor: none
pH: neutral
Water Solubility: infinite
Evaporation Rate: n/av

Boiling Point: n/av
Melting Point: n/av
Specific Gravity: n/av
Vapor Pressure: n/ap
Vapor Density: n/ap

SECTION 4 - FIRE AND EXPLOSION HAZARDS

Flash Point: none Explosive Limits: none
Extinguishing Media: n/ap
Special Firefighting Procedures and Hazards: Material is not combustible. May emit toxic fumes when heated, such as NOx, HCN. HCl. Wear protection as described in Section 6.

SECTION 5 - REACTIVITY INFORMATION

Stable: X Unstable: Precautions: none known
Hazardous Polymerization: Occurs: Does Not Occur: X
Incompatibility: strong acids and oxcidizing agents.
Hazardous Decomposition Products: When heated, possibly NOx, HCN, HCl.

SECTION 6 - HEALTH HAZARDS / PROTECTIVE MEASURES / FIRST AID

Inhalation:

Possible irritation from dusts. (see CHRONIC below)
Use a NIOSH approved respirator for dusts. Get supplier recommendations. Provide adequate ventilation. Minimize dusty conditions.
Remove to fresh air and provide artificial respiration if needed.

Skin:

Possible irritation from dusts. (see CHRONIC below)
Wear dust-proof gloves and other body protection as needed. Minimize dusty conditions.
Wash exposed areas with soap and water for 15 minutes. Remove contaminated clothing, and wash before re-using.

Eyes:

Possible irritation from dust.
Wear dust barrier goggles. Eliminate dusty conditions.
Flush with water for 15 minutes.

Ingestion

No effects expected from normal use and minor amounts ingested. Large amounts, over 1 tablespoon, can cause digestive system upset s. (see CHRONIC below)
Reduce dusting. Avoid mouth breathing. Use facemask. Provide adequate ventilation.
Avoid swallowing. Spit out. Drink large amounts of water. Induce vomiting if person is conscious. Otherwise, and if effects persist, get medical attention.

CHRONIC EFFECTS: None reported for this material. "Cyanides" in general are often reported as toxic to humans. Therefore, it is recommended that exposure via skin, inhalation, and ingestion be limited.

IN ALL CASES: GET MEDICAL ATTENTION IF EFFECTS PERSIST.

Most likely routes of entry: skin, eyes, ingestion.

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE

Spills and Leaks: Take up powder in any container and hold for disposal. Flush residual to sewer or ground. Provide personal protection as described in Section 6.

Storage and Handling: Keep containers closed. Discard any material that may be contaminated. Minimize dusting.

Waste Disposal: Is not listed as RCRA hazardous waste at this date. Cyanides are restricted in water disposed to streams and to sewers. Therefore, landfill disposal is indicated; check with local disposal companies.

Empty Containers: Rinse well. Dispose as appropriate for glass and plastic containers.

SECTION 8 - REGULATORY INFORMATION

DOT: Not regulated.
SARA Title III, S.313, Form R: Nothing reportable.

The information contained herein is based on data available at this time and is believed to be accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Since information contained herein may be applied under conditions beyond our control, and with which we may be unfamiliar, no responsibility is assumed for the results of its use. The person receiving this information shall make his own determination of the suitability of the material for his particular use.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Buffer Solution pH 10.01 ± 0.02
Catalog Number: 2283649

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00370
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: May cause irritation.
Date of MSDS Preparation:
Day: 27
Month: February
Year: 2008

2. COMPOSITION / INFORMATION ON INGREDIENTS

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: > 99.0
Percent Range Units: volume / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: volume / volume
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, blue
Odor: None

HMIS:
Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: None reported
Target Organs: None reported
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water. Call physician if irritation develops.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable

Hazardous Combustion Products: None
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with a dry acid, such as citric or boric. Scoop up slurry into a large beaker. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Flush reacted material to the drain with a large excess of water.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Protect from: heat Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, blue
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 10.0
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: ~100°C (~212°F)
Melting Point: ~0°C (~32°F)
Specific Gravity (water = 1): 0.990

Evaporation Rate (water = 1): 0.76
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Heat Evaporation
Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: None reported

12. ECOLOGICAL INFORMATION

Product Ecological Information: No information available for this product.

Ingredient Ecological Information: None reported

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Open cold water tap completely, slowly pour the reacted material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--

DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA

I.C.A.O.:

I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA

I.M.O.:

I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA

Additional Information: This product may be shipped as part of a chemical kit composed of various compatible dangerous goods for analytical or testing purposes. This kit would have the following classification: Proper Shipping Name: Chemical Kit Hazard Class: 9 UN Number 3316.

---

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

---

16. OTHER INFORMATION

Intended Use: Buffer

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information.

Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

HACH COMPANY ©2008

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Buffer Solution pH 4.01 ± 0.02
Catalog Number: 2283449

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00368
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Practically non-toxic.
Date of MSDS Preparation:
Day: 09
Month: February
Year: 2008

2. COMPOSITION / INFORMATION ON INGREDIENTS

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: >95.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: volume / volume
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Potassium Acid Phthalate
CAS No.: 877-24-7

TSCA CAS Number: 877-24-7
Percent Range: 1.0 - 5.0
Percent Range Units: weight / volume
LD50: Oral rat LDLo = 3200 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

---

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, red liquid
Odor: None

HMIS:
Health: 0
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: No effects are anticipated
Skin Contact: No effects are anticipated
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: No Effects Anticipated
Target Organs: Not applicable
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: No effects anticipated
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

---

4. FIRST AID

Eye Contact: Flush eyes with water. Call physician if irritation develops.
Skin Contact (First Aid): Wash skin with soap and plenty of water.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.

Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: Not applicable
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with an alkali, such as soda ash or sodium bicarbonate. Scoop up slurry into a large beaker. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling.
Storage: Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, red liquid
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 4.01
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: > 100°C (> 212°F)
Melting Point: < 0°C (< 32°F)
Specific Gravity (water = 1): 1.002
Evaporation Rate (water = 1): Not determined
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures
Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Potassium Acid Phthalate: Oral rat LD_{Lo} = 3200 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Open cold water tap completely, slowly pour the reacted material to the drain.

Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

---

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: This product may be shipped as part of a chemical kit composed of various compatible dangerous goods for analytical or testing purposes. This kit would have the following classification: Proper Shipping Name: Chemical Kit
Hazard Class: 9 UN Number 3316.

---

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product does not meet the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): This product is not hazardous under 29 CFR.1910.1200 and therefore is not covered by Title III under SARA.
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): --
Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Buffer

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991.

Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

HACH COMPANY ©2008

In-Situ Inc.
221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)
WWW.IN-SITU.COM

MATERIAL SAFETY DATA SHEET

I. Chemical Product and Company Identification

Product Name:	Manufacturer:	Emergency Contact:
Quick Cal Solution	In-Situ Inc. 221 East Lincoln Avenue Fort Collins, Colorado 80524 Telephone: 970 498 1500 Fax: 970 498 1598	INFOTRAC Emergency Response Hotline: 1-800-535-5053 (in the U.S. and Canada) 1-352-323-3500 www.infotrac.net
Hazardous Shipping Label:	**Dot** None	**IATA** None

II. Ingredients

Hazardous Components Specific Chemical Identity: Common Names	CAS NO.	%	OSHA PEL	ACGIH TLV	LD_{50} (mg/Kg)
Potassium Dihydrogen Phosphate (KH_2PO_4)	7778-77-0	< 1.0	None Listed	None Listed	None Listed
Potassium Chloride (KCl)	7447-40-7	< 1.0	None Listed	None Listed	3020 (ORL-RAT)
Sodium Hydroxide, NaOH	1310-73-2	< 1.0	None Listed	None Listed	1600 (ORL-RAT)
Potassium ferricyanide ($K_3Fe(CN)_6$)	13746-66-2	< 1.0	None Listed	None Listed	None Listed
Potassium ferricyanide trihydrate ($K_3Fe(CN)_6\ 3H_2O$)	14459-95-1	< 1.0	None Listed	None Listed	None Listed
Deionized Water, H_2O	7732-18-5	> 98	None Listed	None Listed	190,000 (IPR-MUS)

III. Physical Data

Boiling Point @ 750 mm Hg	100 °C	**Freezing Point**	0 °C
pH @ 25 °C	7.00	**Vapor Pressure @ 25 °C**	NA
Volatiles % By Wt.	NA	**Solubility in Water, % by Wt @ 25 °C**	Miscible
Vapor Density (Air = 1)	NA	**Evaporation Rate (Butyl, Acetate = 1)**	NA
Specific Gravity (Water = 1)	1.0	**Odor**	odorless
Appearance	Light green Liquid		

IV. Fire And Explosion Hazard Data

Flash Point (Test Method)	Not Flammable	**Autoignition Temperature**	NA
Flammable Limits in air, % by volume		**Lower** NA	**Upper** NA
Extinguishing Media	Water, CO_2, Dry Chemical , Foam Spray	**Special Fire-Fighting Procedures**	None, non-flammable
Unusual Fire & Explosion Hazards	None		

* NA – Not Applicable/not available

In-Situ Inc.

V. Reactivity Data

Stability	*Unstable*	*Stable* X
Conditions to Avoid	None	
Incompatibility (Materials to Avoid)	None	
Hazardous Decomposition Products	None	
Hazardous Polymerization	Cannot Occur	

VI. Health Hazard Data

Routes of Entry	***Inhalation*** Yes	***Skin*** Yes	***Ingestion*** Yes
Health Hazards	***Acute***	Irritation may occur in case of eye or skin contact. Irritation may also occur to mucous membranes from vapors.	
	Chronic	This substance is toxic to blood, lungs, mucous membranes.	
Carcinogenicity	***NTP*** Not Found	***IARC Monographs*** Not Found	***OSHA Regulated*** Not Found
Signs and Symptoms of Exposure	Irritation		
Medical Conditions Generally Aggravated by Exposure	Could Aggravate Diseases of Skin		
Emergency And First Aid Procedures	If skin contact occurs, wash off contact area with water. If ingested, give large amounts of water. Do not induce vomiting. Contact physician.		

VII. Precautions for Safe Handling and Use

Steps to be Taken In Case Material is Released or Spilled	Dilute with water and set aside for diposal
Waste Disposal Method	Consult Federal, State and Local laws for proper disposal.
Precautions To Be Taken In Handling and Storing	Suitable for any general handling storage. NFPA Rating: Scale (0-4); Health –2, Fire – 0, Reactivity – 0, Specific - None
Other Precautions	Do Not Ingest!

VI. Control Measures

Respiratory Protection (specific type)	None	
Ventilation	***Local Exhaust*** None	***Special*** None
	Mechanical (General) Use in Fume Hood	***Other*** None
Protective Gloves Yes	**Eye Protection** Safety Glasses	**Other Protective Clothing or Equipment** None
Work/Hygienic Practices	Emergency eyewash should be available. Wash hands after working with this product	

Appendix K
Portable Generator Hazards

This page was intentionally left blank.

Consumer Product Safety Commission Safety Alert

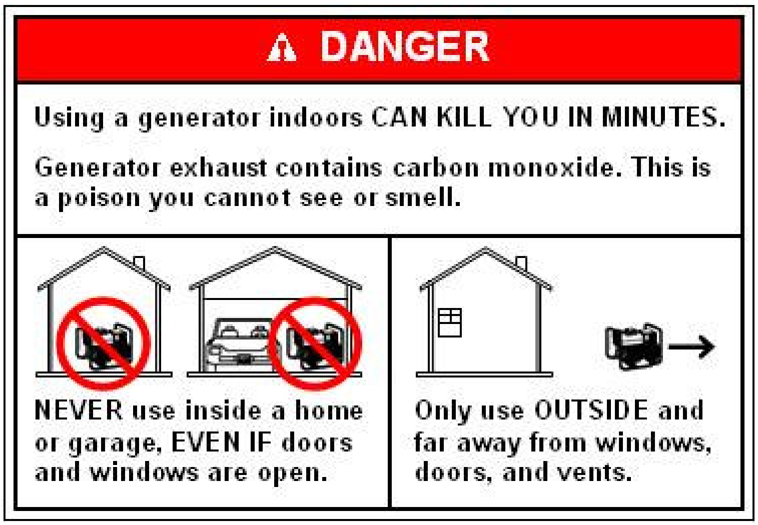
Portable Generator Hazards

Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, fire and burns.

Every year, people die in incidents related to portable generator use. Most of the incidents associated with portable generators reported to CPSC involve CO poisoning from generators used indoors or in partially-enclosed spaces.

Carbon Monoxide Hazards

When used in a confined space, generators can produce high levels of CO within minutes. When you use a portable generator, remember that you cannot see or smell CO. Even if you do not smell exhaust fumes, you may still be exposed to CO.



Danger labels are required on all portable generators manufactured or imported on or after May 14, 2007.

If you start to feel sick, dizzy, or weak while using a generator, get to fresh air **RIGHT AWAY. DO NOT DELAY**. The CO from generators can rapidly kill you.

Follow these safety tips to protect against CO poisoning.

- **NEVER** use a generator inside homes, garages, crawlspaces, sheds, or similar areas, even when using fans or opening doors and windows for ventilation. Deadly levels of carbon monoxide can quickly build up in these areas and can linger for hours, even after the generator has shut off.
- Follow the instructions that come with your generator. Locate the unit outdoors and far from doors, windows, and vents that could allow CO to come indoors.
- Install battery-operated CO alarms or plug-in CO alarms with battery back-up in your home, according to the manufacturer's instructions. CO alarms should be certified to the requirements of the latest safety standards (UL 2034, IAS 6-96, or CSA 6.19.01). Test batteries monthly.

To avoid CO poisoning when using generators:

- Never run generators indoors, including garages, basements, crawlspaces and sheds.
- Get to fresh air right away if you start to feel dizzy or weak.

Electrical Hazards

- Generators pose a risk of shock and electrocution, especially if they are operated in wet conditions. If you must use a generator when it is wet outside, protect the generator from moisture to help avoid the shock/electrocution hazard, but do so without operating the generator indoors or near openings to any building that can be occupied in order to help avoid the CO hazard. Operate the generator under an open, canopy-like structure on a dry surface where water cannot reach it or puddle or drain under it. Dry your hands, if wet, before touching the generator.

- Connect appliances to the generator using heavy-duty extension cords that are specifically designed for outdoor use. Make sure the wattage rating for each cord exceeds the total wattage of all appliances connected to it. Use extension cords that are long enough to allow the generator to be placed outdoors and far away from windows, doors and vents to the home or to other structures that could be occupied. Check that the entire length of each cord is free of cuts or tears and that the plug has all three prongs. Protect the cord from getting pinched or crushed if it passes through a window or doorway.

- **NEVER** try to power the house wiring by plugging the generator into a wall outlet, a practice known as "backfeeding." This is extremely dangerous and presents an electrocution risk to utility workers and neighbors served by the same utility transformer. It also bypasses some of the built-in household circuit protection devices.

Fire Hazards

- **Never** store fuel for your generator in the home. Gasoline, propane, kerosene, and other flammable liquids should be stored outside of living areas in properly-labeled, non-glass safety containers. Do not store them near a fuel-burning appliance, such as a natural gas water heater in a garage.

- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

5123/0407

Send the link for this page to a friend! Consumers can obtain this publication and additional publication information from the Publications section of CPSC's web site or by sending your publication request to info@cpsc.gov.

This document is in the public domain. It may be reproduced without change in part or whole by an individual or organization without permission. If it is reproduced, however, the Commission would appreciate knowing how it is used. Write the U.S. Consumer Product Safety Commission, Office of Information and Public Affairs, 4330 East West Highway, Bethesda, MD 20814 or send an e-mail via CPSC's On-Line Form.

The U.S. Consumer Product Safety Commission is charged with protecting the public from unreasonable risks of serious injury or death from thousands of types of consumer products under the agency's jurisdiction. The CPSC is committed to protecting consumers and families from products that pose a fire, electrical, chemical, or mechanical hazard. The CPSC's work to ensure the safety of consumer products - such as toys, cribs, power tools, cigarette lighters, and household chemicals - contributed significantly to the decline in the rate of deaths and injuries associated with consumer products over the past 30 years.

To report a dangerous product or a product-related injury, call CPSC's hotline at (800) 638-2772 or CPSC's teletypewriter at (800) 638-8270, or visit CPSC's web site at www.cpsc.gov/talk.html. To join a CPSC email subscription list, please go to https://www.cpsc.gov/cpsclist.aspx. Consumers can obtain this release and recall information at CPSC's Web site at www.cpsc.gov.

Consumer Safety (Home) | About CPSC | Library | Business

APPENDIX C – COMMENTS AND RESPONSES

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

444 Hospital Way, #300 • Pocatello, Idaho 83201 • (208) 236-6160

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

5 May 2009

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 1,* April 2009

Dear Mr. Koch,

The Agencies and Tribes have reviewed the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 1,* April 2009, (*2009 & 2010 SWSAP*) submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). In general, the Agencies and Tribes believe that the *2009 & 2010 SWSAP* will produce data of known and adequate quality to support project and task objectives. Revision 1 of the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan* is hereby approved contingent on incorporation of the comments enclosed. Please let me know if you have any questions.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

Enclosure

cc: Robert Geddes (P4/Monsanto)
Cary Foulk (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Agencies and Tribes Comments on
2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 1, April 2009
5 May 2009

General Comments

1-A. Change Draft QAPP Addendum to Final QAPP Addendum as the Agencies and Tribes have now approved it.

1-B. Eliminate zinc as an analyte for analysis. That would include references in Section 3.2.2 and in Appendix A, Field Sampling Plan, Tables 4-3 and 4-4.

1-C. P4/Monsanto identified for fall sampling those sites that had at least one year in which fall concentrations exceeded spring concentrations for both selenium and sulfate. Several other sites had greater fall than spring concentrations for either selenium (1 site) or sulfate (5 sites). Most of the changes between spring and fall were small and were observed in only one of the two years. However, at one site (MST045) sulfate concentrations were higher in fall for both 2007 and 2008. The increases in concentrations of sulfate were substantial (111 to 173 mg/L and 63 to 169 mg/L, respectively). Though all concentrations of sulfate at MST045 were below the secondary state groundwater criterion, the presence of sulfate can often serve as an indicator of human activity. Something appears to be going on at this site and the Agencies and Tribes believe that P4/Monsanto should continue to do both spring and fall sampling at MST045 until the source of the sulfate is better understood. Please add MST045 to the list of sites to be sampled in both spring and fall.

Specific Comments

1-1. Section 3.2.1, page 3-6. This section presents a relative hierarchy of screening values "...in order of most applicable to least applicable." There does not appear to be any need to present these sources of potentially useful screening values in the form of a "hierarchy." All are potentially useful. Revise text to indicate that all of these various sources of screening values were considered, and that the most sensitive risk-based values were typically used, except as noted in the text. The rationale for any departures from this approach needs to be explained.

1-2. Section 3.2.1, page 3-12, paragraph 1. The text indicates there were 6 sampling events for MDS025, 4 of which encountered a dry site. Table 3-4 shows that there were 5 sampling events at MDS025. Please reconcile. In addition, the May 06 manganese concentration was 0.012 mg/L, which is below the 0.05 mg/L benchmark in Table 3-2. Therefore, the primary exceedance for Mn, as shown in Table 3-4, must be from the May 01 sampling event. Is that correct?

1-3. Section 3.2.1, page 3-13, paragraph 2. Delete last sentence indicating that the EPA regional screening level is "deemed applicable and appropriate." The Agencies and Tribes disagree with the premise that the "regional screening level" is a more appropriate screening value than the promulgated drinking water MCL when a waterbody is not in current use as a drinking water source. The use and application of MCLs as ARARs in the Superfund program are set forth in various EPA policy statements and guidance documents pertaining to ARARs. Nevertheless, the rationale for not sampling for uranium (based on the fact that U exceeded the MCL at only one of the spatially relevant sample stations) explained in Section 3.2.2 is adequate.

1-4. Section 3.2.2, page 3-13, paragraph 3, bullet 3. Should the method for vanadium analysis be 6010B to be in line with the 27 Apr 09 conference call and Appendix A, Field Sampling Plan, Table 4-3?

Appendices

1-5. Appendix A, Field Sampling Plan, Table 3-1, page 3-2. Add MST045 as a site to be sampled as part of the 2009 and 2010 fall sampling events.

1-6. Appendix A, Field Sampling Plan, Section 4.8, page 4-7, paragraph 1, bullet 4. *Distilled water* should be deionized water.

Editorial Comments

General: Be consistent in capitalizing or not capitalizing spring and fall.

Section 1.0, page 1-1, paragraph 4, line 2. Add a period to the end of the sentence.
Section 2.0, page 2-1, paragraph 1, line 5. The period should be before the parenthesis.
Section 2.0, page 2-1, paragraph 3, line 3. *Principle* should be principal. It is correct in Table 2-1. Please change wherever needed.
Section 2.0, page 2-2, paragraph 4, bullet 1. Put a space between the hyphen and *contaminants* and capitalize *contaminants*.
Section 2.0, page 2-2, paragraph 4, bullet 3. Add a period at the end of the bullet.
Table 2-1, page 2-3, Step 1, bullet 3. Add a period at the end of the bullet.
Table 2-1, page 2-5, Step 4, Temporal Boundary. Add a comma between *i.e.* and *peak.*
Section 3.2.1, page 3-13, paragraph 2, line 7. Delete *were.*

Response to 05 May 2009 Agencies and Tribes Comments on the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 1, 22* April 2009

General Comments

1-A. Change Draft QAPP Addendum to Final QAPP Addendum as the Agencies and Tribes have now approved it.

> Response: *The SAP and FSP text have been revised to reference the Final QAPP Addendum.*

1-B. Eliminate zinc as an analyte for analysis. That would include references in Section 3.2.2 and in Appendix A, Field Sampling Plan, Tables 4-3 and 4-4.

> Response: *Zinc has been removed as an analyte from Section 3.2.2 of the SAP and Tables 4-3 and 4-4 of the FSP.*

1-C. P4/Monsanto identified for fall sampling those sites that had at least one year in which fall concentrations exceeded spring concentrations for both selenium and sulfate. Several other sites had greater fall than spring concentrations for either selenium (1 site) or sulfate (5 sites). Most of the changes between spring and fall were small and were observed in only one of the two years. However, at one site (MST045) sulfate concentrations were higher in fall for both 2007 and 2008. The increases in concentrations of sulfate were substantial (111 to 173 mg/L and 63 to 169 mg/L, respectively). Though all concentrations of sulfate at MST045 were below the secondary state groundwater criterion, the presence of sulfate can often serve as an indicator of human activity. Something appears to be going on at this site and the Agencies and Tribes believe that P4/Monsanto should continue to do both spring and fall sampling at MST045 until the source of the sulfate is better understood. Please add MST045 to the list of sites to be sampled in both spring and fall.

> Response: *Station MST045 has been included for fall sampling in Section 3.2.3 of the SAP and Table 3-1 of the FSP.*

Specific Comments

1-1. Section 3.2.1, page 3-6. This section presents a relative hierarchy of screening values "…in order of most applicable to least applicable." There does not appear to be any need to present these sources of potentially useful screening values in the form of a "hierarchy." All are potentially useful. Revise text to indicate that all of these various sources of screening values were considered, and that the most sensitive risk-based values were typically used, except as noted in the text. The rationale for any departures from this approach needs to be explained.

> Response: *The text has been revised to refer to screening criteria instead of screening hierarchy.*

1-2. Section 3.2.1, page 3-12, paragraph 1. The text indicates there were 6 sampling events for MDS025, 4 of which encountered a dry site. Table 3-4 shows that there were 5 sampling events at MDS025. Please reconcile. In addition, the May 06 manganese concentration was 0.012 mg/L, which is below the 0.05 mg/L benchmark in Table 3-2. Therefore, the primary exceedance for Mn, as shown in Table 3-4, must be from the May 01 sampling event. Is that correct?

Response: *Table 3-4 was correct and included five events. The text has been revised to include five (5) sampling events, three (3) of which were dry. In addition, the text was revised to state that the May 2001 sampling event reported a manganese concentration of 5 mg/L, which exceeded the screening criteria.*

1-3. Section 3.2.1, page 3-13, paragraph 2. Delete last sentence indicating that the EPA regional screening level is “deemed applicable and appropriate.” The Agencies and Tribes disagree with the premise that the “regional screening level” is a more appropriate screening value than the promulgated drinking water MCL when a waterbody is not in current use as a drinking water source. The use and application of MCLs as ARARs in the Superfund program are set forth in various EPA policy statements and guidance documents pertaining to ARARs. Nevertheless, the rationale for not sampling for uranium (based on the fact that U exceeded the MCL at only one of the spatially relevant sample stations) explained in Section 3.2.2 is adequate.

Response: *The sentence has been deleted to address this comment.*

1-4. Section 3.2.2, page 3-13, paragraph 3, bullet 3. Should the method for vanadium analysis be 6010B to be in line with the 27 Apr 09 conference call and Appendix A, Field Sampling Plan, Table 4-3?

Response: *The bullet has been revised to report the correct analytical method for vanadium as 6010B.*

Appendices

1-5. Appendix A, Field Sampling Plan, Table 3-1, page 3-2. Add MST045 as a site to be sampled as part of the 2009 and 2010 fall sampling events.

Response: *This table has been revised to include MST045 in the fall 2009 and 2010 sampling events.*

1-6. Appendix A, Field Sampling Plan, Section 4.8, page 4-7, paragraph 1, bullet 4. *Distilled water* should be deionized water.

Response: *The text has been revised to reflect this change.*

Editorial Comments

General: Be consistent in capitalizing or not capitalizing spring and fall.

Section 1.0, page 1-1, paragraph 4, line 2. Add a period to the end of the sentence.
Section 2.0, page 2-1, paragraph 1, line 5. The period should be before the parenthesis.
Section 2.0, page 2-1, paragraph 3, line 3. *Principle* should be principal. It is correct in Table 2-1. Please change wherever needed.
Section 2.0, page 2-2, paragraph 4, bullet 1. Put a space between the hyphen and *contaminants* and capitalize *contaminants*.
Section 2.0, page 2-2, paragraph 4, bullet 3. Add a period at the end of the bullet.
Table 2-1, page 2-3, Step 1, bullet 3. Add a period at the end of the bullet.
Table 2-1, page 2-5, Step 4, Temporal Boundary. Add a comma between *i.e.* and *peak*.
Section 3.2.1, page 3-13, paragraph 2, line 7. Delete *were*.

Response: *The editorial revisions have been made.*

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

444 Hospital Way, #300 • Pocatello, Idaho 83201 • (208) 236-6160

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

16 April 2009

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 0,* March 2009

Dear Mr. Koch,

The Agencies and Tribes have reviewed the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 0,* March 2009, (*2009 & 2010 SWSAP*) submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). This sampling and analysis plan supports continued surface water data collection at strategic sample stations and for key water quality parameters. The general objective of this monitoring activity is to ensure a continuous period of record which will facilitate trend analysis and effectiveness monitoring in the future. Agency/Tribal comments on the *2009 & 2010 SWSAP* are provided below.

The *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 0,* March 2009, is considered a deliverable under the CO/AOC, and per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing." In observance of our review process, I will schedule time on the Monday, 27 April 2009, conference call to answer any questions you might have on the Agency/Tribal comments. Subsequently, the next version of the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan* is due no later than 27 May 2009.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and Tribes, discussions to resolve those issues should be initiated. However, after the Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

Please let me know if you have any questions. I can be reached at 208-236-6160 or electronically at michael.rowe@deq.idaho.gov.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

Enclosure

cc: Robert Geddes (P4/Monsanto)
Cary Foulk (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman, (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Agencies and Tribes Comments on
2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 0, March 2009
16 April 2009

General Comments

The following comments are a result of the 1 April 2009 conference call to talk about Data Quality Objectives for surface water sampling.

0-A. Steps 5 and 7 appropriately include language for decreasing the number of surface water monitoring locations, however the alternative scenario where data may reveal that new monitoring locations are needed is absent. The text should be revised to address both alternatives.

0-B. The introduction and Data Quality Objectives table (Table 2-1) describe this portion of the surface water sampling effort for the Sites as interim monitoring to provide a continuous record of conditions. A statement needs to be included in Step 1 (Problem Statement), that data collected under this effort will also be of use in the ongoing phased groundwater investigation, especially for refining the hydrogeological conceptual models of the Sites. It is essential that this connection between the surface water sampling effort and the groundwater sampling effort be documented and recognized, especially as the coordination of synchronizing the sampling of surface water and the alluvial groundwater system is so critical.

0-C. The plan rationale should be revised to acknowledge the potential connectivity between groundwater and surface water and to describe how surface water monitoring may also benefit groundwater monitoring, and vice versa. For the purpose of clarification, the plan rationale should include a note that the groundwater investigation and monitoring is being performed under a separate SAP.

0-D. As mentioned, coordinating sampling of surface water and the alluvial groundwater system is critical to better understand the connection between surface water and groundwater. A study question should be added to Step 2 of the DQOs that ties timing of surface water sampling to the alluvial groundwater investigation.

0-E. Please delete the adjective "inactive" for the word "mines" when referring to the areas under CERCLA characterization. In order to be consistent with the 2003 Administrative Order on Consent/Consent Order (AOC/CO), it is more appropriate to refer to the project area(s) as the Site(s).

0-F. It was suggested that the number of sampling events and number of exceedances be added to Table 3-3 or a new table.

The following comments came out of the 14 April 2009 meeting between P4/Monsanto, MWH, and the Agencies and Tribes that included discussion on surface water sampling for 2009 and 2010.

0-G. It was agreed to substitute site MST044 for MST234.

0-H. We discussed the need for sampling major ions other than sulfate, magnesium, and calcium. The Agencies and Tribes suggested P4/Monsanto and MWH think about reducing the major ions to sample and provide appropriate rationale. Major ions would need to be sampled for any new site that may eventually be added to the Sampling and Analysis Plan.

0-I. P4/Monsanto was directed by the Agencies and Tribes to include both aluminum and uranium in the suite of parameters to be sampled in surface water for 2007 and 2008. To date we have seen no analysis of those Al and U data although in Table 3-3 P4/Monsanto makes the argument to stop sampling for Al. Please provide a brief summary and analysis of the Al and U data collected at the surface water sites in 2007 and 2008, and include a discussion of whether U sampling needs to be continued.

0-J. P4/Monsanto has proposed one sampling event in the spring based on the CSM premise that "In general, the predominant mobilization mechanism for COPCs from these potential source areas occur during the spring runoff via surface water and shallow groundwater transport of dissolved constituents." For the spring sampling event, P4/Monsanto agreed to the extent practical to sample at the peak of the hydrograph. The Agencies and Tribes believe that a fall sampling event is warranted and would help in understanding fate and transport of COPCs. The Agencies and Tribes are directing P4/Monsanto to examine the spring and fall data for selenium and sulfate at the identified sampling sites and provide a table in the document with the pertinent data. Those sites with higher Se and SO_4 concentrations in the fall than in the spring should be sampled in the fall or justification offered as to why not.

Additional comments

0-K. Please add the following language in 1.0 Introduction. This sampling and analysis plan is being submitted as a deliverable under the Consent Order/Administrative Order on Consent for the Performance of Site Investigations and Engineering Evaluations/Cost Analysis (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho (08/20/03), EPA Docket No. CERCLA-10-2003-0117.

0-L. It is the understanding of the Agencies and Tribes that many of the surface water stations used in the past for site characterization are referred to as surface expressions of groundwater, and that future sampling for those sample locations will be documented in the phased groundwater sampling plan.

0-M. The Agencies and Tribes remind P4/Monsanto that future surface water sampling could change as to sites and COPCs to sample depending on future data, data needs to support fate and transport of COPCs in groundwater, etc.

Specific Comments

0-1. Section 3.1, page 3-1. A figure should be added to the SAP to support the rationale for the sample locations listed in Table 3-1. To accomplish this, the Agencies recommend that P4/Monsanto highlight the selected sample stations on one of the existing Selenium Surface Water Spatial Wire Diagram (e.g., the 2008 Spring Selenium Spatial Wire Diagram of Figure 11 from the DSR) and include that figure as part of the SAP and/or the FSP, as appropriate.

0-2. Section 3.2, 3-3. Include a table that lists all selenium data for the sample locations selected under 1st Phase – Spatial Relevance (Section 3.1). Again, this will support the rationale for the sample locations listed in Table 3-1.

0-3. Section 3.2.1, page 3-4. The discussion of the hierarchy of the screening values does not include the national recommended aquatic standards; however, these standards are included in Table 3-2 (last column). Include the national recommended aquatic standards in the hierarchy discussion, as well.

0-4. Table 3-2, page 3-7. Rather than use the Cr III acute and chronic criteria for total chromium for surface water quality standards for aquatic life, the Cr VI criteria should be used.

0-5. Table 3-2, page 3-6. P4/Monsanto selected Idaho's chronic water quality criteria as the applicable screening value for cadmium which is less stringent than the national recommended aquatic criterion for cadmium. Since the purpose of this table is to screen against conservative criteria, then P4/Monsanto should use the national criterion for cadmium or provide a justifiable reason for not doing so. The table should also include the water quality criteria for organism consumption to demonstrate that the screening values are sufficiently protective of this exposure route, as well.

0-6. Table 3-2, page 3-6. Replace the EPA Region IX PRGs with EPA's Regional Screening Levels for Chemical Contaminants at Superfund Sites which can be downloaded from the EPA website http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. These updated screening levels should be used in lieu of EPA Region 3 RBCs, Region 6 HHMSSLs, and the Region 9 PRGs.

0-7. Table 3-2, page 3-7. There does not appear to be a footnote for superscript e and there are two footnotes for superscript g.

0-8. Section 3.2.1, page 3-8, paragraph 1. The text states that "... all stations have at least one exceedance of a chemical." However, Table 3-3 does not have "Xs" for any chemical for stations MST051, MST063, or MST090. Revise the text and/or the table accordingly.

0-9. Table 3-3, page 3-8. In its current form, this table lists all sample stations in numerical order, regardless of mine. The table should be revised, listing the sample stations by mine to help the reviewer correlate sample stations with the corresponding mine, similar to Table 3-1. Furthermore, replace the “Xs” in the table with the maximum factor of exceedance of each COPC relative to the corresponding screening criteria.

Drawings

0-10. Drawing 1. Please include dump seeps (MDS), agricultural wells (MAW), domestic wells (MDW), production wells (MPW), etc., in the legend.

Appendices

0-11. Appendix A, Section 4.0, page 4-1. Sample collection documentation should include photo documentation of the sample location. Add text to this section on how photo documentation of sample locations will be conducted.

Editorial Comments

Table 3-3, page 3-8. MSD025 should be MDS025.

Response to Agencies and Tribes Comments on the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Revision 0, 18* March 2009

General Comments

The following comments are a result of the 1 April 2009 conference call to talk about Data Quality Objectives for surface water sampling.

0-A. Steps 5 and 7 appropriately include language for decreasing the number of surface water monitoring locations, however the alternative scenario where data may reveal that new monitoring locations are needed is absent. The text should be revised to address both alternatives.

Response: *Steps 5 and 7 of the DQOs in Table 2-1 have been revised to include text regarding a scenario where additional monitoring locations may be required.*

0-B. The introduction and Data Quality Objectives table (Table 2-1) describe this portion of the surface water sampling effort for the Sites as interim monitoring to provide a continuous record of conditions. A statement needs to be included in Step 1 (Problem Statement), that data collected under this effort will also be of use in the ongoing phased groundwater investigation, especially for refining the hydrogeological conceptual models of the Sites. It is essential that this connection between the surface water sampling effort and the groundwater sampling effort be documented and recognized, especially as the coordination of synchronizing the sampling of surface water and the alluvial groundwater system is so critical.

Response: *Text has been added to Section 1.0 Introduction, (page 1-1, paragraph 2, last sentence) as well as Step 1 of the DQOs in Table 2-1 (paragraph 1, last sentence) to address this comment.*

0-C. The plan rationale should be revised to acknowledge the potential connectivity between groundwater and surface water and to describe how surface water monitoring may also benefit groundwater monitoring, and vice versa. For the purpose of clarification, the plan rationale should include a note that the groundwater investigation and monitoring is being performed under a separate SAP.

Response: *Text has been added to Section 3.1, second paragraph on page 3-2 to address this comment.*

0-D. As mentioned, coordinating sampling of surface water and the alluvial groundwater system is critical to better understand the connection between surface water and groundwater. A study question should be added to Step 2 of the DQOs that ties timing of surface water sampling to the alluvial groundwater investigation.

Response: *A second study question has been added to the DQOs in Table 2-1 that addresses the timing and connection between surface water and groundwater sampling.*

0-E. Please delete the adjective "inactive" for the word "mines" when referring to the areas under CERCLA characterization. In order to be consistent with the 2003 Administrative

Order on Consent/Consent Order (AOC/CO), it is more appropriate to refer to the project area(s) as the Site(s).

Response: *The Plan has been revised to remove the adjective "inactive" when referring to the mines. Section 1.0 Introduction has been revised to refer to P4's three inactive mines as the "Sites."*

0-F. It was suggested that the number of sampling events and number of exceedances be added to Table 3-3 or a new table.

Response: *A new Table 3-4, "Summary of Sampling Events and Exceedances for Retained Surface Water Monitoring Stations", is included in the revised plan.*

The following comments came out of the 14 April 2009 meeting between P4/Monsanto, MWH, and the Agencies and Tribes that included discussion on surface water sampling for 2009 and 2010.

0-G. It was agreed to substitute site MST044 for MST234.

Response: *The Plan has been revised to substitute site MST044 for MST234.*

0-H. We discussed the need for sampling major ions other than sulfate, magnesium, and calcium. The Agencies and Tribes suggested P4/Monsanto and MWH think about reducing the major ions to sample and provide appropriate rationale. Major ions would need to be sampled for any new site that may eventually be added to the Sampling and Analysis Plan.

Response: *Section 3.2.2 has been revised to remove sodium, potassium, and alkalinity and includes a discussion of the rationale to do so. In addition, the Field Sampling Plan in Appendix A has been revised to remove these analytes.*

0-I. P4/Monsanto was directed by the Agencies and Tribes to include both aluminum and uranium in the suite of parameters to be sampled in surface water for 2007 and 2008. To date we have seen no analysis of those Al and U data although in Table 3-3 P4/Monsanto makes the argument to stop sampling for Al. Please provide a brief summary and analysis of the Al and U data collected at the surface water sites in 2007 and 2008, and include a discussion of whether U sampling needs to be continued.

Response: *A summary of the Al and U screening are included in Section 3.2.1, as well as the rationale for not including Al and U in the 2009 and 2010 surface water analyte list.*

0-J. P4/Monsanto has proposed one sampling event in the spring based on the CSM premise that "In general, the predominant mobilization mechanism for COPCs from these potential source areas occur during the spring runoff via surface water and shallow groundwater transport of dissolved constituents." For the spring sampling event, P4/Monsanto agreed to the extent practical to sample at the peak of the hydrograph. The Agencies and Tribes believe that a fall sampling event is warranted and would help in understanding fate and transport of COPCs. The Agencies and Tribes are directing P4/Monsanto to examine the spring and fall data for selenium and sulfate at the identified sampling sites and provide a table in the document with the pertinent data. Those sites with higher Se and SO_4 concentrations in the fall than in the spring should be sampled in the fall or justification offered as to why not.

Response: *The 2007 and 2008 spring and fall selenium and sulfate data are presented in the new Section 3.2.3 and the new Table 3-5, Summary of Selenium and Sulfate Concentrations and Seasonal Sampling Evaluation, along with rationale for sampling those sites where selenium and sulfate concentrations have been observed highest in the fall.*

<u>Additional comments</u>

0-K. Please add the following language in 1.0 Introduction. This sampling and analysis plan is being submitted as a deliverable under the Consent Order/Administrative Order on Consent for the Performance of Site Investigations and Engineering Evaluations/Cost Analysis (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho (08/20/03), EPA Docket No. CERCLA-10-2003-0117.

Response: *This language has been added to Section 1.0 Introduction.*

0-L. It is the understanding of the Agencies and Tribes that many of the surface water stations used in the past for site characterization are referred to as surface expressions of groundwater, and that future sampling for those sample locations will be documented in the phased groundwater sampling plan.

Response: *Agreed. The groundwater sampling plan will include some stations that are surface expressions of groundwater. Text has been added to Section 3.1, paragraph 2 on page 3-2 that addresses this comment.*

0-M. The Agencies and Tribes remind P4/Monsanto that future surface water sampling could change as to sites and COPCs to sample depending on future data, data needs to support fate and transport of COPCs in groundwater, etc.

Response: *Steps 5 and 7 of the DQOs in Table 2-1 acknowledge that the stations and analytes may need to be evaluated based on future results.*

Specific Comments

0-1. Section 3.1, page 3-1. A figure should be added to the SAP to support the rationale for the sample locations listed in Table 3-1. To accomplish this, the Agencies recommend that P4/Monsanto highlight the selected sample stations on one of the existing Selenium Surface Water Spatial Wire Diagram (e.g., the 2008 Spring Selenium Spatial Wire Diagram of Figure 11 from the DSR) and include that figure as part of the SAP and/or the FSP, as appropriate.

Response: *The SAP includes a new Figure 1 that depicts highlighted spatially-relevant sampling locations on the Spring 2008 Selenium Spatial Wire Diagram. This Figure is referenced in Section 3.1, page 3-1.*

0-2. Section 3.2, 3-3. Include a table that lists all selenium data for the sample locations selected under 1st Phase – Spatial Relevance (Section 3.1). Again, this will support the rationale for the sample locations listed in Table 3-1.

Response: *Table 3-1 has been revised to show those spatially relevant locations, as well as the available selenium data.*

0-3. Section 3.2.1, page 3-4. The discussion of the hierarchy of the screening values does not include the national recommended aquatic standards; however, these standards are included in Table 3-2 (last column). Include the national recommended aquatic standards in the hierarchy discussion, as well.

Response: *As stated in Section 3.1, "The evaluations of screening values considered first the use of an applicable promulgated standard and second the use of the most conservative surface water screening value." The national recommended aquatic standards are not promulgated standards compared to the State of Idaho standards and therefore were not used in the hierarchy screening discussion. The text has been revised in Section 3.2 to include a statement that the national recommended aquatic standards may be considered in the future.*

0-4. Table 3-2, page 3-7. Rather than use the Cr III acute and chronic criteria for total chromium for surface water quality standards for aquatic life, the Cr VI criteria should be used.

Response: *Table 3-2 has been revised for clarity to reference both the Cr III and Cr VI criteria for the surface water quality standards for aquatic life.*

0-5. Table 3-2, page 3-6. P4/Monsanto selected Idaho's chronic water quality criteria as the applicable screening value for cadmium which is less stringent than the national recommended aquatic criterion for cadmium. Since the purpose of this table is to screen against conservative criteria, then P4/Monsanto should use the national criterion for cadmium or provide a justifiable reason for not doing so. The table should also include the water quality criteria for organism consumption to demonstrate that the screening values are sufficiently protective of this exposure route, as well.

Response: *As stated in Section 3.1, "The evaluations of screening values considered first the use of an applicable promulgated standard and second the use of the most conservative surface water screening value." The national recommended aquatic standards are not promulgated standards compared to the State of Idaho standards and therefore were not used in the hierarchy screening discussion. For cadmium, regardless of what standard was used in the screening, this chemical is included in 2009 and 2010 analytical suite. In addition, water quality criteria for organism consumption have been added to the screening table, Table 3-2, in the final columns of the table.*

0-6. Table 3-2, page 3-6. Replace the EPA Region IX PRGs with EPA's Regional Screening Levels for Chemical Contaminants at Superfund Sites which can be downloaded from the EPA website http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. These updated screening levels should be used in lieu of EPA Region 3 RBCs, Region 6 HHMSSLs, and the Region 9 PRGs.

Response: *Table 3-2 has been revised to replace the EPA PRGs with the EPA's Regional Screening Levels for Chemical Contaminants at Superfund Sites.*

0-7. Table 3-2, page 3-7. There does not appear to be a footnote for superscript e and there are two footnotes for superscript g.

Response: *Table 3-2 has been revised to correct this footnote discrepancy.*

0-8. Section 3.2.1, page 3-8, paragraph 1. The text states that ". . . all stations have at least one exceedance of a chemical." However, Table 3-3 does not have "Xs" for any chemical for stations MST051, MST063, or MST090. Revise the text and/or the table accordingly.

Response: *The text, first paragraph on page 3-8, has been revised accordingly.*

0-9. Table 3-3, page 3-8. In its current form, this table lists all sample stations in numerical order, regardless of mine. The table should be revised, listing the sample stations by mine to help the reviewer correlate sample stations with the corresponding mine, similar to Table 3-1. Furthermore, replace the "Xs" in the table with the maximum factor of exceedance of each COPC relative to the corresponding screening criteria

Response: *Table 3-3 has been reorganized by mine to correlate to Tables 3-1 and include maximum exceedance factors where previously an "X" was shown.*

Drawings

0-10. Drawing 1. Please include dump seeps (MDS), agricultural wells (MAW), domestic wells (MDW), production wells (MPW), etc., in the legend.

Response: *The drawing has been revised to include these items in the legend as well as to substitute MST044 for MST234.*

Appendices

0-11. Appendix A, Section 4.0, page 4-1. Sample collection documentation should include photo documentation of the sample location. Add text to this section on how photo documentation of sample locations will be conducted.

Response: *Section 4.0 of the Field Sampling Plan in Appendix A has been revised to discuss photo documentation of sampling locations.*

Editorial Comments

Table 3-3, page 3-8. MSD025 should be MDS025.

Response: *The editorial revisions have been made.*

ATTACHMENT 2
2009 GROUNDWATER MONITORING
SAMPLING AND ANALYSIS PLAN

Spring MSG005 at Ballard Mine

P4 PRODUCTION

2009 GROUNDWATER MONITORING SAMPLING AND ANALYSIS PLAN

FINAL
Revision 3

Prepared by

P_4 Production, LLC

MWH

2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

August 2009

August 10, 2009

Mr. Mike Rowe
IDEQ
444 Hospital Way, #300
Pocatello, ID 83201

RE: ***2009 Groundwater Monitoring Sampling and Analysis Plan***
Final – Revision 3

Dear Mike,

Please find enclosed the final 2009 Groundwater Monitoring Sampling and Analysis Plan, which is being submitted on behalf of P4 Production (P4). This final version incorporates comments listed in the approval letter provided by the Agencies and Tribes on 3 August 2009.

As always, if you have any questions please do not hesitate to contact Barry Koch at (208) 547-1439 or myself at (970) 879-6260.

Best Regards,

Cary L. Foulk
Supervising Geologist/Geochemist

Hard copy, CD and electronic version:
- Mike Rowe, Doug Tanner*, Bruce Olenick*, Cindy Steed*, IDEQ
- Gerry Winter, IDEQ
- USFS Soda Spring District Office
- Mary Kauffman, USFS
- Jason Sturm, BLM
- Kelly Wright, Shoshone-Bannock Tribes
- Cary Foulk, MWH
- Tim Mosko, CH2M Hill
- Sandi Arena, USFWS
- Lorraine Edmond, USEPA
- Dave Tomten, USEPA
- Allen Ruberry, IDL
- Bill Wiley, BIA
- Barry Koch, Monsanto
- Dave Farnsworth, Monsanto
- Randy White, Monsanto
- Dale Ralston, RHS

Electronic version only:
- Joe Wallace, USEPA
- Jim McCulloch, Monsanto
- Mike Vice, Monsanto
- Patrick McCullough, Monsanto
- Don Wind, Monsanto
- Paul Stenhouse, Monsanto
- Bob Geddes, Monsanto

*These people share hard copies with the main recipient on the list. They are also included on the email distribution.

2353 130th Ave NE, Suite 200
Bellevue, Washington
98005 USA
Tel: 425 896 6900
Fax: 425 602 4020
BUILDING A BETTER WORLD

Response to 3 August 2009 Agencies and Tribes Comments on the *2009 Groundwater Water Monitoring Sampling and Analysis Plan, Revision 2, 24 July* 2009

General Comments

None

Specific Comments

2-1. Table 2-1, page 2-5, Step 4, Temporal boundary. When explaining the decision factors for sampling in the fall, it might make sense, and would be more consistent, to use the new language found in Section 3.3.3, paragraph 1 on page 3-13.

Response: *Text has been revised to be consistent with the language found in section 3.3.3.*

Appendices

Field Sampling Plan

2-2. Table 4-1. Add other parameters to be analyzed such as gross alpha and gross beta, hardness, and total suspended solids.

Response: *Table has been revised to include all containers and parameters.*

Editorial Comments

Section 2.0, page 2-1, paragraph 3, line 3. Change *principle* to "principal."
Table 2-1, page 2-5, Step 3, bullet 7. It appears that this bullet would be improved by insertion of a comma(s), such as "existing site characterization, groundwater quality sampling and analysis plans and procedures".
Table 2-1, page 2-6, Step 4, Practical Constraints. Delete the comma and insert a closing parenthesis after *MDS034*.
Table 2-1, page 2-6, Step 5, Principal Study Question #3, line 2. Insert a comma for the last *and* to read ". . . groundwater and surface water, aid in review . . ."
Table 2-1, page 2-7, Step 7, line 2. Change *is* to "are."
Section 3.3.2, page 3-11, bullet 5 (Dump seeps, springs, and streams), line 6. Change *bee* to "be."
Section 3.3.3, page 3-13, paragraph 3 (last), line 4. Add a period after criteria and capitalize *these* to read ". . . groundwater quality criteria. These locations . . ."

Appendices

Field Sampling Plan

Table 4-3, page 4-8, column 2. Add “MWs” after *2008* to read “2008 MWs & MMW009”.

Table 4-5, pages 4-12 and 4-13. Change the title of the table to “. . . and 2009 Monitoring Wells”.

Table 4-5, page 4-12, column 6. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, add “Cr” in the column beginning *Total Cd*.

Table 4-5, page 4-12, column 7. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, add “Fe” in the column beginning *Total Al*.

Table 4-7, page 4-17, column 10. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, delete *K* and *Na* in the column beginning *Dissolved Ca*.

Response: *The editorial revisions have been made.*

2009 GROUNDWATER MONITORING

SAMPLING AND ANALYSIS PLAN

FINAL
Revision 3

AUGUST 10, 2009

TABLE OF CONTENTS

1.0 INTRODUCTION....................1-1
2.0 DATA QUALITY OBJECTIVES....................2-1
3.0 GROUNDWATER LOCATION AND ANALYTICAL RATIONALE....................3-1
3.1 SPATIAL/CATEGORICAL RELEVANCE....................3-1
3.2 CHEMICAL QUALITY/ANALYTICAL SCREENING....................3-2
3.2.1 Screening Criteria....................3-3
3.3 LOCATION/ ANALYTE SELECTION....................3-7
3.3.1 Location Selection....................3-7
3.3.2 Analyte Selection....................3-9
3.3.3 Seasonal Sampling Evaluation....................3-13
4.0 REFERENCES....................4-1

LIST OF TABLES

Table 2-1 Groundwater Monitoring DQOs....................2-3
Table 3-1 Achievable Laboratory Limits and Applicable Project Screening Values Groundwater Parameters....................3-5
Table 3-2 Summary of Total Metals Fractions Maximum Factors of Exceedance in Groundwater....................3-6
Table 3-3 2009 Groundwater Proposed Analyte List....................3-10
Table 3-4 Summary of Selenium and Sulfate Concentrations and Seasonal Sampling Evaluation....................3-14

APPENDICES

Appendix A Field Sampling Plan
Appendix B Comments and Comment Response Documents

ACRONYMS AND ABBREVIATIONS

A/T	Agencies and Tribes
Al	Aluminum
Ca	Calcium
$CaCO_3$	Calcium carbonate
Cd	Cadmium
Cl	Chloride
COPC	Contaminant of Potential Concern

Cr	Chromium
DQOs	Data Quality Objectives
e.g.	*exempli gratia* (Latin, for example)
EE/CA	Engineering Evaluation/Cost Analysis
Fe	Iron
FOE	Factor of Exceedance
FSP	Field Sampling Plan
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
i.e.	*id est* (Latin, that is to say; in other words)
K	Potassium
MCL	Maximum Contaminant Level
mg/L	Milligrams per Liter
Mg	Magnesium
Mn	Manganese
MWH	MWH, Inc. (formerly Montgomery Watson Harza, Inc.)
Na	Sodium
Ni	Nickel
P4	P4 Production, L.L.C.
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RA	Risk Assessment
RI/FS	Remedial Investigation/Feasibility Study
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
Se	Selenium
SI	Site Investigation
SO_4	Sulfate
SOP	Standard Operating Procedure
V	Vanadium
Zn	Zinc

1.0 INTRODUCTION

This document was prepared collaboratively between P4 Production and MWH. It presents the relevant component documents for a Sampling and Analysis Plan (SAP) for the 2009 groundwater monitoring program at the P4 Production, L.L.C. (P4) mines near Soda Springs, Idaho. The mines include the properties of Ballard, Henry, and Enoch Valley mines, collectively referred to as the Sites. This sampling and analysis plan is being submitted as a deliverable under the Consent Order/Administrative Order of Consent for the Performance of Site Investigations and Engineering Evaluations/Cost Analysis (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho (08/20/03), EPA Docket No. CERCLA-10-2003-0117.

Characterization of groundwater at the Sites has been conducted in a phased approach since 2004. The *Draft 2007 and 2008 Data Summary Report* (MWH, 2009a) provides a summary of the most recent groundwater characterization results. As noted in this document, ongoing monitoring of Contaminants of Potential Concern (COPC) concentrations and piezometric conditions in monitoring wells and specific seeps and springs is needed to complete characterization of the nature and extent of COPCs in groundwater. The groundwater data collected under this plan will also support the evaluation of surface water/groundwater interaction and refinement of the hydrogeologic conceptual models of the Sites.

The components of this SAP include the field sampling plan (FSP), quality assurance project plan (QAPP), and health and safety plan (HSP). The FSP is included in Appendix A. The QAPP and HSP, which are not modified, are included by reference as *QAPP Addendum* (MWH, 2009d) and *Health and Safety Plan* (MWH, 2009c), respectively. In addition, as it is a key part of the project planning process, the data quality objectives (DQOs) are presented in this document in Section 2.0.

While the SAP and FSP components are prepared as complete documents, it needs to be recognized that this continued groundwater monitoring is part of the overall characterization of the P4 Sites. Therefore the larger work plan and SAP components are not repeated herein (i.e., an abbreviated SAP is presented). For complete background on the overall characterization of the Sites the following overall work plan documents should be referenced:

- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan—Final* (MWH, 2004a)
- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Project Field Sampling Plan—Final* (MWH, 2004b)
- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Field Sampling Plan—Final* (MWH, 2004e)
- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Quality Assurance Plan—Final* (MWH, 2004c)

- *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Health and Safety Plan—Final* (MWH, 2004d)
- *Quality Assurance Project Plan Addendum Program Quality Assurance Plan – Final* (MWH, 2009d) (*QAPP Addendum*)

2.0 DATA QUALITY OBJECTIVES

The DQOs discussed in this section were used to guide the development of the sampling program. They identify the objectives and quality of data that must be obtained to perform continued groundwater characterization and monitoring to support the decision making process related to the current engineering evaluation/cost analysis (EE/CA) program. (Work is currently underway to transition this program to a remedial investigation/feasibility study (RI/FS) program.)

The DQOs are consistent with EPA guidance (USEPA, 2006) and apply the following seven-step process:

1. State the problem
2. Identify the goals of the study
3. Identify information inputs
4. Define the boundaries of the study
5. Develop the analytic approach
6. Specify performance or acceptance criteria
7. Develop the plan for obtaining data

DQOs have been specifically developed to guide the screening and selection of the groundwater monitoring stations and analytes, which are the most substantial modifications to the groundwater program. Within these, the principal study question (from Step 2) has a corresponding statement, as appropriate, in each of the remaining DQO steps. Outputs are given in each step and follow the 2006 DQO guidance (USEPA, 2006).

Each step of the DQO Process defines criteria that will be used to establish the final data collection design. The first five steps are primarily focused on identifying qualitative criteria, such as:

- the nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated;
- the decisions or estimates that need to be made and the order of priority for resolving them;
- the type of data needed; and
- an analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings (USEPA, 2006).

The sixth step establishes acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data. For this groundwater monitoring program, the data are primarily collected for the measurement of analyte levels in groundwater to characterize potential contamination and potential risk to human health and ecological receptors, and as such, the uncertainty in the data will be estimated and evaluated once collected. Current EPA-approved methods will be used for estimation of the level of uncertainty associated with the data.

In the seventh step of the DQO Process, a data collection design is developed that will generate data meeting the quantitative and qualitative criteria specified at the end of Step 6. The output from this step is largely contained in the FSP.

Two key factors that need to be considered in the DQO process are the conceptual model, for helping formulate the problem statements (DQO Step 1), and in this case, the facility map for identifying the spatial bounds of the program. The conceptual model is presented here to support the DQOs detailed in Table 2-1, *Groundwater Monitoring DQOs*. The facility map is included in the FSP.

The primary components of the conceptual model that support the DQOs are summarized as follows for groundwater:

- Source – COPCs present in interburden and overburden rocks deposited in waste rock dumps, but possibly present in mine pits and other facilities, that are able to enter groundwater systems due to seepage and/or runoff and infiltration.

- Release mechanisms – Exposure to air and water results in mobilization of COPCs from increased surface area; precipitation may leach and mobilize COPCs primarily during spring runoff to receiving groundwater.

- Exposure pathways – Primary exposure through ingestion of COPCs in surface expressions of groundwater or direct ingestion from water supply wells.

- Receptors – Livestock, wildlife, or human ingestion of surface expressions of groundwater or water supply wells with elevated COPCs.

These conceptual model components will be re-evaluated, refined, and verified as the project moves into risk assessment.

TABLE 2-1 GROUNDWATER MONITORING DATA QAULITY OBJECTIVES	
Step 1 - State the Problem	Historical mining operations at P4's Sites have resulted in mine waste materials being potential sources of selenium and other constituents to the environment. In general, the predominant mobilization mechanism for COPCs from these potential source areas occur during the spring runoff via surface water and shallow groundwater transport of dissolved constituents. However, deeper infiltration to intermediate or regional groundwater systems is also possible. Groundwater characterization has been conducted in a phased approach. Continued investigation and monitoring is needed to assist in determination of the nature and extent of selenium and other COPC impacts in groundwater. In addition, the groundwater monitoring provides beneficial information regarding groundwater/surface water interaction, which will assist in refinement of the hydrogeologic conceptual models of the Sites for the identification of potential removal or remedial actions. The primary components of the conceptual model that support the DQOs are summarized as follows for groundwater: • Source – COPCs present in interburden and overburden rocks deposited in waste rock dumps, but possibly present in mine pits and other facilities, that is able to enter groundwater systems due to seepage and/or runoff and infiltration. • Release mechanisms – Exposure to air and water results in mobilization of COPCs from increased surface area; precipitation may leach and mobilize COPCs primarily during spring runoff to receiving groundwater. • Exposure pathways – Primary exposure through ingestion of COPCs in surface expressions of groundwater or direct ingestion from water supply wells. • Receptors – Livestock, wildlife, or human ingestion of surface expressions of groundwater or water supply wells with elevated COPCs. The planning team, decision makers, and principal data users include P4 and the A/T.
Step 2 – Identify the Goals of the Study	Principal Study Question #1 Are COPCs in groundwater monitoring wells and surface expressions of groundwater that assist in groundwater characterization elevated above the appropriate screening levels[1] that may pose risks to human health and ecological receptors? Alternative actions: 1. Evaluate the need to sample additional downgradient wells or conduct additional characterization. 2. No Action. No further characterization is required and the data will be forwarded to the site investigation (SI) and risk assessment (RA). Decision statement: The decision is to determine whether the groundwater COPC concentrations are

[1] Table 3-1, *Achievable Laboratory Limits and Applicable Project Screening Values Groundwater Parameters,* contains the applicable risk-based screening levels.

TABLE 2-1 GROUNDWATER MONITORING DATA QAULITY OBJECTIVES	
	elevated above the groundwater standard (e.g., 0.05 mg/L for selenium) that may pose risks to human health or ecological receptors and if groundwater is contributing to surface water bodies such that the surface water quality standards are being exceeded. If monitoring wells are found to be equal to or exceed the groundwater standard or surface expressions of groundwater are found to be equal to or exceed the surface water quality standard, then additional downgradient wells need to be sampled. If the downgradient wells at the edge of a plume are equal to or exceed the standards, then the need for additional characterization in that area will be evaluated. If increasing trends are observed temporally, the need for additional monitoring or characterization will also be evaluated. All data will be evaluated in the site investigation (SI) and risk assessment (RA). If monitoring well concentrations are less than the groundwater standards or less than the surface water quality standard for surface expressions of groundwater, then no further characterization is required and the data will be forwarded to the SI and RA. Principal Study Question #2 Are surface expressions of groundwater (seeps, springs, and headwaters) associated with potential P4 sources being adequately monitored (spatially and temporally) by the surface and groundwater monitoring station network in order to constrain the hydrogeologic conceptual model and the nature and extent of contamination? Alternative actions: 1. Evaluation indicates that the surface expressions of groundwater can be optimized and the number of stations and/or analytes adjusted for future monitoring. Data will be forwarded to the SI and RA. 2. No Action. Station data and analyte list are of adequate quality, quantity, and in proper locations to constrain the conceptual model and nature and extent of contamination. Data will be forwarded to the SI and RA. Decision statement: Determine whether seep, spring, and headwater monitoring stations and analytes assist in defining the hydrogeologic conceptual model and nature and extent of contamination. If not, modify the number, analyte list, and/or locations of the monitoring stations sampled; otherwise, the existing stations and analyte list will continue to be sampled. Principal Study Question #3 Are temporal changes in groundwater associated with changes in surface water quality and vice versa? Alternative actions: 1. Monitor the temporal changes in surface water and alluvial groundwater during similar times of the year as specified in the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan* (MWH, 2009c) and this Groundwater Monitoring Sampling and Analysis Plan. Evaluation indicates that the monitoring network can be optimized and the number of stations and/or analytes adjusted for future interim monitoring. Data will be forwarded to the SI and RA. 2. No Action. Station data and analyte lists are of adequate quality, quantity, and in proper locations to determine the relationship (if any) between temporal changes in groundwater and surface water quality. Data will be forwarded to the SI and RA. Decision statement: Determine what effect temporal changes in groundwater quality have on surface water

TABLE 2-1 GROUNDWATER MONITORING DATA QAULITY OBJECTIVES	
	quality, and vice versa in order to evaluate the potential interconnection between the two systems to aid in review of fate and transport of COPCs and evaluation of removal or remedial actions. Modify the number, analyte list, and/or locations of the monitoring stations sampled in order to determine the potential effect these changes may have on each system; otherwise, the existing stations and analyte list will continue to be sampled.
Step 3 – Identify Information Inputs	The information inputs for the decision process include the following items that may exist or will need to be created. • list of analytes • current conceptual site models • existing facilities investigation information to be updated as needed (inventory and spatial delineation of potential source areas) • sample location maps (contained in FSP) • historic surface water and groundwater data (use of existing data will be dependent upon evaluations of data usability); data will be analyzed with appropriate methods for determining inorganic concentrations with detection limits suitable for comparison to risk-based screening levels • hydrogeologic information such as flow directions, flow rates, and distance of wells to seeps and springs • existing site characterization, groundwater quality sampling and analysis plans and procedures • risk-based screening benchmarks for analytes
Step 4 – Define the Boundaries of the Study	Population of Interest: Metals/metalloids and general groundwater quality parameters. Spatial boundaries: Groundwater monitoring locations, including surface expressions of groundwater, characterizing impacted groundwater at Ballard, Henry, and Enoch Valley mine areas. Vertical boundary: Screened depth of groundwater monitoring well and practical depth of monitoring well installation. Temporal boundary: The temporal boundary for groundwater monitoring at all proposed stations is spring 2009 during peak flow (i.e., peak potential loading). This is due to the nature of contaminant transport positively correlating with spring runoff and the potential hydraulic connections between the shallow alluvial system and surface water. Sites for fall sampling were retained based on the following: (1) higher selenium or sulfate

TABLE 2-1 GROUNDWATER MONITORING DATA QAULITY OBJECTIVES	
	concentrations in the fall compared to the spring, (2) selenium or sulfate concentrations greater than the applicable groundwater quality standard, (3) lack of historical fall sample data, and (4) increasing concentrations trends. Additional wells installed in fall 2009 will be monitored following development. Scale of Decision Making: Spatially-relevant groundwater monitoring locations from each sampling event. Practical Constraints Sampling to occur during peak flow in spring. Some proposed sample locations (e.g., MDS025 and MDS034) may be dry in the fall.
Step 5 – Develop the Analytic Approach	Principal Study Question #1 The relevant compliance threshold linked to protection of human health is 0.05 mg Se/L in groundwater. The relevant compliance threshold linked to protection of ecological health is 0.005 mg Se/L in surface water. If monitoring location selenium concentrations are equal to or exceeds these standards then further downgradient boundary monitoring will be evaluated, otherwise the selenium plume is considered bounded by the existing monitoring locations. Other COPCs will be evaluated, but for groundwater at P4's sites, selenium has been found to be the best indicator of impacts associated with mine waste areas. Principal Study Question #2 If a monitoring station and/or analyte are not required to evaluate potential impacts to surface expressions of groundwater sites (dump seeps and springs) from potential upgradient P4 sources, then the need for the monitoring points and/or analytical parameters will be evaluated. For example, some stations may be redundant. If the proposed monitoring stations and/or analytes are not sufficient to constrain the hydrogeological conceptual model, evaluate temporal trends, and constrain the nature and extent of contamination, then the need for additional monitoring points and/or analytical parameters will be evaluated. Otherwise the proposed locations and analytes will be considered adequate for the intended purpose of defining the conceptual model. Principal Study Question #3 If a monitoring station and/or analyte are not required to evaluate potential relationships and temporal trends between groundwater and surface water, aid in review of the fate and transport of COPCs and evaluation of removal or remedial actions, then the need for the monitoring points and/or analytical parameters will be evaluated. If the proposed monitoring stations and/or analytes are not sufficient to evaluate the relationship between groundwater and surface water, then the need for additional monitoring points and/or analytical parameters will be evaluated. Otherwise the proposed locations and analytes will be considered adequate for the intended purpose of evaluating the relationship between surface water and alluvial groundwater and assisting in evaluation of fate and transport of COPCs.
Step 6 – Specify Performance or Acceptance Criteria	A groundwater monitoring location that assists in characterization of the groundwater system will be retained. A surface expression of groundwater station (seeps, springs, and streams) located downstream of a potential P4 source area solely characterizing potential P4 surface

TABLE 2-1 GROUNDWATER MONITORING DATA QAULITY OBJECTIVES	
Step 6 – Specify Performance or Acceptance Criteria	A groundwater monitoring location that assists in characterization of the groundwater system will be retained. A surface expression of groundwater station (seeps, springs, and streams) located downstream of a potential P4 source area solely characterizing potential P4 surface water quality impacts will be retained for ongoing characterization and effectiveness monitoring. Best professional judgment will be used to evaluate the hydrogeologic factors associated with the monitoring stations, and how these factors may be relevant to the need for ongoing monitoring. Analytical parameters will be compared to the applicable groundwater quality risk-based screening level[2]. The precision, accuracy, representativeness, comparability, and completeness criteria and the minimum detection limits will be used to evaluate the usability of analytical data in making decisions about characterization of groundwater and at a minimum will help ensure that data collected for the interim monitoring will be of comparable quality when compared to the 2004-2008 site characterization data. Measurement errors will be minimized by implementing standard operating procedures for the sample collection, handling, preparation and analysis methods. All data must meet approved usability as defined in the *QAPP Addendum* (MWH, 2009b).
Step 7 – Develop the Plan for Obtaining Data	The existing groundwater data were reviewed as part of the preparation of this SAP. The sampling rationale and design based on existing data are presented in Section 3.0 of this SAP. The sampling design included screening of existing spatially-relevant surface expressions of groundwater locations as well as evaluation of analytes that exceed applicable groundwater quality risk-based standards. The sampling design will be further evaluated if groundwater monitoring suggests that the proposed locations and analytes are not sufficient to assist in groundwater characterization. The field methods and quality assurance requirements are presented in the FSP located in Appendix A.

[2] Table 3-1, *Achievable Laboratory Limits and Applicable Project Screening Values Groundwater Parameters,* contains the applicable risk-based screening levels.

3.0 GROUNDWATER LOCATION AND ANALYTICAL RATIONALE

A purpose of this plan is to identify a network of groundwater monitoring locations for the characterization of nature and extent of constituents in groundwater and to identify an applicable analyte list.

P4 anticipates installing additional monitoring wells in fall 2009, as part of the continued groundwater characterization to address identified data gaps. The locations and number of those wells are generally known. The analyte list for these new locations is discussed in Section 3.3. P4 anticipates finalizing these additional characterization activities during calendar year 2009 with A/T input and approval. For the existing monitoring and borehole wells (pre-pack wells installed during the 2008 Direct Push Program), seeps, and springs, it is proposed that all the proposed locations are sampled in spring 2009 following surface water sampling and a specific subset of the proposed locations will be sampled in fall 2009. Monitoring wells installed in fall 2009 will be sampled post-development during the same period.

Unvalidated, censored groundwater quality data were evaluated from previous investigations. All values below the reporting limit were reported as surrogates at that reporting limit. The summarized results of this evaluation are presented in Sections 3.2 and 3.3, as well as an analyte list for future monitoring at existing and proposed groundwater points.

3.1 SPATIAL/CATEGORICAL RELEVANCE

P4 evaluated five types of groundwater monitoring locations— monitoring wells, borehole monitoring wells, production/domestic/agricultural wells, dump seeps, springs, and streams. The categories were evaluated for spatial adequacy to characterize groundwater, as well as the amount of available data collected from 2004 onward. Surface expressions of groundwater (headwater stream locations) were also evaluated for future performance monitoring in the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan* (MWH, 2009b).

The spatial/categorical relevance of groundwater monitoring locations was evaluated. The purpose of this evaluation was to determine if various groundwater features, in close proximity, had similar chemical results. If groundwater points were in close proximity and chemically similar, then logically, one location could be used as a surrogate point to characterize changes to groundwater as part of characterization and any future performance monitoring. An example of this evaluation can be seen at Ballard Mine. Dump seeps MDS030—MDS033 are all in close proximity to each other along the western edge of MWD093, above the MMP035 high wall. The proximity evaluation was limited to dump seeps and springs.

Monitoring wells or production/domestic/agricultural wells were excluded from this spatial evaluation. P4 will continue to sample groundwater quality at all monitoring wells (MMW---) for the 2009 field season to add to the existing groundwater quality data, and because a number of these wells have been installed only in the last two years. Production/domestic/agricultural wells will not be sampled as discussed in Section 3.3 below.

Existing dumps seeps, and springs are suitable for monitoring groundwater quality at Ballard, Henry, and Enoch Valley mines based on their location. The supporting rationale for retaining or rejecting sampling points at Henry and Enoch Valley mines is driven chiefly by the existing water quality results, presented in Section 3.2. At Ballard Mine, P4 believes that the four seeps MDS030—MDS033 characterize the same groundwater unit due to their close proximity to one another, and all being situated along the western edge of the Ballard mine pit #2 overburden dump (MWD093) above the Pit #1 (MMP035) high wall. As such, P4 will sample only one of these dump seeps going forward, as the water chemistry at these four dump seeps is similar, and P4 has a sampling record at these four locations since spring 2004 (seven sampling events—four spring and three fall).

3.2 CHEMICAL QUALITY/ANALYTICAL SCREENING

The second part of the evaluation screened total fractions in past water quality data against the current list of approved groundwater analytes from IDEQ (IDEQ, 2008). Both IDEQ and USEPA groundwater screening benchmarks are for total chemical fractions.

The current list of approved analytes is (IDEQ, 2008):

- [Filtered] aluminum (Al), cadmium (Cd), calcium (Ca), chloride (Cl), chromium (Cr), iron (Fe), magnesium (Mg), manganese (Mn), nickel (Ni), potassium (K), selenium (Se), sodium (Na), sulfate (SO_4), total alkalinity (Alk), vanadium (V), zinc (Zn).
- [Unfiltered] aluminum (Al), cadmium (Cd), chromium (Cr), iron (Fe), manganese (Mn), nickel (Ni), selenium (Se), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), vanadium (V), zinc (Zn).

MW009 required an expanded analyte list, in addition to the above analyte list:

- [Filtered] arsenic (As), barium (Ba), boron (B), lead (Pb), molybdenum (Mo), thallium (Tl), uranium (U).
- [Unfiltered] arsenic (As), barium (Ba), boron (B), lead (Pb), molybdenum (Mo), thallium (Tl), uranium (U).

3.2.1 Screening Criteria

Table 3-1, *Achievable Laboratory Limits and Applicable Project Screening Values Groundwater Parameters,* presents the available screening criteria that were compiled for this analytical screening phase. This table also shows the highlighted screening value chosen for screening groundwater data. The applicable screening values were evaluated for each of the groundwater analytes. The evaluations of screening values considered first the use of an applicable promulgated state standard and second the use of a conservative groundwater screening value. The selected standards considered for screening analytes is presented below.

1) IDAPA 58.01.11 Ground Water Quality Rule Primary and Secondary Constituents Standards.
   Cadmium, unspeciated chromium, and selenium were evaluated under the primary constituent standards. Aluminum, chloride, iron, manganese, sulfate, total dissolved solids, and zinc were evaluated against the secondary constituent standards.

2) IDEQ Risk Management Plan Monitoring Action Level Groundwater Trending and Release Detection.
   Nickel and vanadium were evaluated under these advisory levels. The risk management plan advisory levels are based on the Clean Water Act/Water Quality Standard Criteria (nickel) and Tier II Secondary Chronic Benchmarks (vanadium).

3) USEPA National Primary Drinking Water Standards Maximum Contaminant Levels.
   Uranium was evaluated using this benchmark.

4) USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs) (USEPA, 2008).
   Aluminum, iron, manganese, uranium, and zinc were evaluated secondarily under these tap water screening benchmarks. These chemicals were evaluated under a second tier for limited exceedances observed for secondary groundwater criteria, since Idaho secondary groundwater criteria are not health based.

Dissolved fractions were not evaluated in the water quality evaluation. Personal communications with IDEQ (Ed Hagan) and USEPA (Safe Drinking Water Hotline, 800-426-4791) indicate that screening benchmarks are only relevant for total chemical fractions. IDEQ indicated that when one has total chemical fractions, one must use those for evaluating water quality. In order to use dissolved fractions in conjunction with, or in lieu of, total fractions, one must provide rationale and obtain special permission from IDEQ to do so. The results of the screening are presented in Table 3-2, *Summary of Total Metal Fractions Maximum Factors of Exceedance in Groundwater*. Within this table are the maximum factors of exceedance for those groundwater monitoring points where water quality benchmarks are exceeded. MMW009 groundwater quality data were included in this data set.

Water quality data from MMW009 were screened against the same criteria as above and included an expanded analyte list. A change in the screening was the use of USEPA maximum contaminant levels (MCL) against uranium concentrations, as this MCL is more conservative than USEPA RSLs. Dissolved fractions were not evaluated for MMW009 as outlined in the preceding paragraph.

Exceedances (and maximum factors of exceedance [FOE]) for MMW009 were the following:

- aluminum (12.2)—No exceedances if evaluated against USEPA RSLs.
- beryllium (2.5)
- cobalt (4.5)
- iron (7.3) —No exceedances if evaluated against USEPA RSLs.
- lead (1.9)
- manganese (3.7) —No exceedances if evaluated against USEPA RSLs.

Although analyte screening was evaluated, it will not be utilized for MMW009. P4 proposes to sample MMW009 for the same expanded analytical suite used for 2008 and 2009 monitoring wells as discussed in Section 3.3.

TABLE 3-1

ACHIEVABLE LABORATORY LIMITS AND APPLICABLE PROJECT SCREENING VALUES
GROUNDWATER PARAMETERS
(Page 1 of 1)

			Achievable Laboratory Limits [2]		Applicable Screening Levels: State of Idaho Standard Ground Water [3]	IDEQ Area Wide RMP [4] Groundwater Levels		EPA MCL [7]		EPA Regional SL [8]	Health Comparison Values of Drinking Water [9]	
Method	**Monitoring Parameter [1]**	**Units**	**RL**	**MDL**		**Removal [5]**	**Monitoring [6]**	**Primary**	**Secondary**	**Tap Water**	**Child**	**Adult**
EPA 6020A	Cadmium	mg/L	0.0005	0.000125	0.005	0.005	0.0010	0.005	- -	0.018	- -	- -
	Chromium (total)	mg/L	0.002	0.0005	0.1	0.1	0.0250	0.1	- -	55 [a]	0.1	0.1
	Manganese	mg/L	0.002	0.0005	(0.05)	- -	- -	- -	- -	0.88	- -	- -
	Nickel	mg/L	0.004	0.001	- -	0.73	0.160	- -	- -	0.73	- -	- -
	Selenium	mg/L	0.001	0.0005	0.05	0.050	0.0050	0.05	- -	0.18	- -	- -
	Uranium	mg/L	0.040	0.010	- -	- -	- -	0.03 [b]	- -	0.11	0.03 [b]	0.03 [b]
	Zinc	mg/L	0.025	0.005	(5)	5.0	0.100	- -	- -	11	- -	- -
EPA 6010B	Aluminum	mg/L	0.1	0.05	(0.2)	- -	- -	- -	- -	37	- -	- -
	Calcium	mg/L	0.2	0.1	- -	- -	- -	- -	- -	- -	- -	- -
	Iron	mg/L	0.1	0.025	(0.3)	- -	- -	- -	- -	26	- -	- -
	Magnesium	mg/L	0.5	0.25	- -	- -	- -	- -	- -	- -	- -	- -
	Potassium	mg/L	1	0.25	- -	- -	- -	- -	- -	- -	- -	- -
	Sodium	mg/L	0.5	0.25	- -	- -	- -	- -	- -	- -	- -	- -
	Vanadium	mg/L	0.01	0.005	- -	0.26	0.020	- -	- -	0.26	- -	- -
EPA 300.0	Chloride	mg/L	0.2	0.1	(250)	- -	- -	- -	- -	- -	- -	- -
	Sulfate	mg/L	1	0.5	(250)	- -	- -	- -	- -	- -	- -	- -
SM2340B	Hardness	mg/L	5	5	- -	- -	- -	- -	- -	- -	- -	- -
EPA 310.2	Alkalinity, total	mg/L	10	5	- -	- -	- -	- -	- -	- -	- -	- -
EPA 160.1	TDS	mg/L	10	5	(500)	- -	- -	- -	500	- -	- -	- -
EPA 160.2	TSS	mg/L	5	2.5	- -	- -	- -	- -	- -	- -	- -	- -

Primary source for screening   Secondary choice for screening   No available screening benchmark

[1] The project- or event-specific target parameter list will be established prior to the sampling event; samples may or may not be analyzed for all listed parameters.
[2] Generally achievable laboratory reporting limits; method detection limits will vary annually and by laboratory.
[3] State of Idaho Ground Water Quality Rule (IDAPA 58.01.11); secondary standard in parentheses.
[4] Removal action and monitoring levels; Area Wide Risk Management Plan (RMP; IDEQ 2004).
[5] Values are "total recoverable" (unfiltered).
[6] Values are unfiltered.
[7] EPA primary and secondary Maximum Contaminant Level (MCL), National Primary Drinking Water Regulations, EPA (http://www.epa.gov/safewater/contaminants/index.html#rads, 17 March 2008).
[8] EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, 12 September 2008).
[9] Public Health Assessment: Southeast Idaho Phosphate Mining Resource Area: Bannock, Bear Lake, Bingham, and Caribou Counties, Idaho EPA Facility ID: IDN001002245 (U.S. Department of Health and Human Services, Public Health Services, Agency for Toxic Substances and Disease Registry, 2006).

[a] Value is for chromium III.
[b] Reporting limit is greater than screening value, but MDL is less than the screening value.

CWA - Clean Water Act
IDAPA Idaho Administrative Protection Agency'
IDEQ - Idaho Department of Environmental Quality
mg/L - milligrams per liter
na - not applicable to this method
pCi/L - picocuries per liter
TDS - total dissolved solids
TSS - total suspended solids

TABLE 3-2
SUMMARY OF TOTAL METAL FRACTIONS
MAXIMUM FACTORS OF EXCEEDANCE IN GROUNDWATER

Station	Mines, Aquifer	Al[2]	Cl	Cd	Cr	Fe[2]	Mn[2]	Ni	Se	SO4	TDS	U[2]	V	Zn
MDS016	H					NS	NS			1.5	1.5	NS		
MDS022	H	5.6				4.9	12.3				1.2			
MDS025	E					NS	NS		34.8	3.4		NS	5.3	
MDS026	E			8.0		1.1	19.3(1.1)		8.6	3.4	3.1	1.5	2.5	
MDS030	B	9.9				5.4	2.1		18.4		1.2			
MDS031	B	5.1				1.6			15.4		1.4			
MDS032	B	13.5				7.6			29.2	2.6	2.4			
MDS033	B	10.1				6.4	1.2		44.0	3.0	2.9			
MDS034	H					2.7	1.6		2.8		1.1			
MMW004[1]	H, A			100.0	5.0	3.6	60.0	18.8			1.0		50.0	123.4
MMW006	B, R								1.6					
MMW007	E, A	2.4				1.2	12.2							
MMW008	E, A	43.8				23.2	9.1							
MMW009	E, R	12.2				7.3	3.7							
MMW010	H, A			1.1		1.2	67.8(3.9)		2.0	2.2	2.5			
MMW011	H, R	1.2				1.4	1.5							
MMW013	E, I						3.0		1.8	1.3	1.3			
MMW014	H, A					2.3	18.9(1.1)				1.2			
MMW017	B, A	1.1					9.6		2.6	1.8	2.1			
MMW018	B, A						1.4							
MMW019	H, I										1.1			
MMW020	B, R	1.2		2.2		3.7	1.6				1.0		1.9	
MMW021	B, R						3.4							
MMW022	H, I	1.6					2.1			1.1	1.3			
MMW023	H, R					16.6	18.7(1.1)	1.1			1.5			
MMW024[3]	E, I	1.8				1.1					1.0	NS		
MMW025[3]	E, I	6.9				3.4	1.4					NS		
MMW026[3]	E, R											NS		
MMW027[3]	E, I								6.3		1.4	NS		
MMW028[3]	H, I											NS		
MMW029[3]	B, I								16.1	2.2	2.7	NS		
MMW030[3]	B, W						1.7					NS		
MMW031[3]	B, W											NS		
MPW006	E, R/I	NS		NS	NS	NS	NS	NS	NS		NS	NS	NS	NS
MPW019	E, ?					5.6	1.0							
MPW020	E, R/I	NS		NS	NS	NS	NS	NS	NS		NS	NS	NS	NS
MPW022[1]	H, I			100.0	5.0	26.9	60.0	18.8					50.0	109.4
MPW023	H, I					1.0	4.1							
MSG001	E													
MSG002	H	4.7				2.5	2.3					NS		
MSG003	B								12.8		1.3			
MSG004	B	21.1				4.5	8.3		1.0					
MSG005	B						2.1						2.5	
MSG006	B	4.4				2.8	8.3		5.6	2.4	1.5			
MSG007	B	21.9				14.1	6.0			7.2	1.1			
MSG008	B	1.3			2.7			1.1	6.8	1.8	1.8			
MST096	B	9.5				4.8	1.1		1.0					
MST136	E	1.4												

TABLE 3-2
SUMMARY OF TOTAL METAL FRACTIONS
MAXIMUM FACTORS OF EXCEEDANCE IN GROUNDWATER

MST144	E			1.0		NS	NS		4.6	1.8		NS		

Notes:

1) Unusually high reporting limits in fall 2005 for MMW004 or MPW022 only. These two locations were re-evaluated with fall 2005 results removed from the data pool. No exceedance observed in MMW004, or MPW022 if shaded green. Or, the new maximum factor of exceedance is shown parenthetically. Fall 2005 analytical results for Cd, Cr, Mn, Ni, V, and Zn showed high reporting limits due to sample dilution in the analytical method (the reporting limits is typically adjusted upward by the factor of dilution). Zn concentrations in fall 2005 were 3—5 orders of magnitude higher than any subsequent monitoring.

2) Al, Fe, Mn, and U were secondarily evaluated against USEPA RSLs because the primary screening values (IDAPA 58.01.11) are secondary standards based on aesthetics. For these four chemicals, blue shading indicates that no exceedance was observed when compared against the USEPA RSL benchmarks. New maximum factors of exceedance are shown parenthetically, where appropriate.

3) Monitoring well installed in 2008.

"NS" and gray shading indicate no analytical data for that location. If a cell is blank with no shading, a sample was collected and the maximum factor of exceedance is < 1. For MPW006 and MPW020, dissolved fractions were collected for many analytes, including Se, which are not relevant for comparing to IDEQ/USEPA screening benchmarks.

A = Alluvial – may include colluvium, weathered Dinwoody Formation or basalt
I = Intermediate – typically Dinwoody Formation, but may include Thaynes or Phophoria Formations
R = Regional – Wells Formation
H = Henry Mine
B = Ballard Mine
E = Enoch Valley Mine

The results presented in this table show the majority of exceedances are found for selenium, sulfate, and TDS. To a lesser extent, exceedances also occur for cadmium and vanadium. It must be noted that agricultural, domestic, and borehole wells were not included in the analytical screening. Domestic and agricultural wells are not included in the 2009 sampling program. In addition, all borehole monitoring wells are being sampled and were not screened spatially or analytically as discussed in Section 3.3.

3.3 LOCATION/ ANALYTE SELECTION

3.3.1 Location Selection

Based on the results of the screening, P4 recommends retaining or excluding the following locations, by category:

Monitoring Wells: P4 will sample all MMW--- locations in 2009. Additional wells installed in fall 2009 will also be included for monitoring. Wells that have been replaced by new monitoring wells (e.g., MMW001) will be excluded. In addition, wells MW-15A andMW-16A will also be sampled at the Ballard Mine as they are located within plumes on the west side of the mine. These two wells were installed for the Blackfoot Bridge Environmental Impact Study baseline data collection program but will be now be incorporated into the 2009 groundwater monitoring program for the SI.

Production Wells: P4 will exclude production wells from any future monitoring programs. The results in Table 3-2 from the groundwater quality evaluation show no selenium or other chemical exceedances in these production wells (the initial maximum factors of exceedance shown in Table 3-2 are attributable to unusually high fall 2005 reporting limits or for iron or manganese secondary criteria exceedances under IDAPA 58.01.11). Additionally, P4 has a record of several sampling efforts for these locations. In addition, given uncertainty regarding the construction of these wells and hydrogeologic units screened, it not advisable to rely on these wells for characterization. However, it has been prudent to sample these locations as potential locations for direct exposure to the COPCs.

Agricultural and Domestic Wells: For reasons similar to the production wells, agricultural and domestic wells (MAW and MDW) will not be sampled.

Dump seeps: P4 will continue to monitor dumps seeps MDS025, -026, -030, and -034. Dumps seeps MDS016 and MDS022 at Henry Mine will be excluded due to limited and low maximum factors of exceedance for SO_4 and TDS, as well as limited exceedances of Al, Fe, and Mn in MDS022 against IDAPA secondary standards. Dumps seeps MDS025 and MDS026 at Enoch Valley Mine, show exceedances of selenium and other analytes. Additionally, MDS030 will be used as a surrogate for MDS031—033, as outlined in Section 3.1 above. P4 will continue to monitor MDS034 due to limited water quality data at this location.

Springs: P4 will continue to monitor MSG004—007. MSG001—003 will be excluded from future monitoring because P4 has a record of several sampling events for these locations. MSG001 and MSG002 have shown no selenium exceedances. P4 has monitored MSG003 seven times to date. MSG008, Hayfield Pipe, will not be monitored in 2009 because P4 believes this water to be from the same source as MST069, Short Creek, which is scheduled for continued monitoring under this groundwater plan and under the surface water monitoring program as described in the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan* (MWH, 2009b). MSG008 also empties into the Short Creek channel, south of the haul road.

Streams (surface expressions of groundwater): P4 will continue to monitor MST096 at Ballard mine as this location represents the easternmost monitoring point for the southeast plume at MWD082. In addition, location MST136 and MST144 at Enoch Valley will also be monitored to evaluate potential impacts from MWD092.

Borehole Monitoring Wells: This is an additional groundwater monitoring category for 2009 to include the existing borehole monitoring wells (pre-pack wells) installed during the 2008 direct push groundwater investigation. Those pre-pack wells that are currently in place will be monitored during the 2009 groundwater investigation. At Ballard Mine, MBW006, -009, -011, -026, -027, -028, -032, -048 will be monitored. At Enoch Valley Mine, MBW085, -087, -099, -107, -112 will be monitored. No direct push pre-pack wells are installed at Henry Mine. Pre-pack wells will also be installed during the 2009 direct push continuation effort. Details can be found in the *Direct Push Groundwater Continuation Sampling and Analysis Plan* (P4, 2009).

3.3.2 Analyte Selection

The analyte selection below presents the proposed analyte list for 2009 groundwater monitoring in Table 3-3, *2009 Groundwater Proposed Analyte List*. Based on IDEQ and USEPA guidance, P4 recommends that only unfiltered or total fractions be analyzed for metals. While dissolved metal fractions have been measured in the past and are more useful for geochemical evaluations, they are not directly comparable to applicable IDEQ and USEPA screening benchmarks for groundwater. At this time P4 believes that sufficient dissolved fraction metals data from a sufficient number of wells is available to make geochemical interpretations.

Direct push borehole wells installed in 2008 will not be filtered for metals. However, if a borehole well cannot be effectively developed in accordance with standard procedures specified in the FSP, resulting in highly turbid water samples, the samples will be filtered.

The recent direction given by IDEQ related to the analytical parameters for groundwater (e-mail, 28 April 2009 at 12:15) was the following:

> *"We would remind you that new wells drilled in 2008 need to be sampled for the expanded list of analytes. Also, 2008 pre-packs will need to be sampled for the "regular" list of analytes, including major ions for water-typing. We realize that samples from the pre-packs will be analyzed for dissolved fractions only."*

Based on this direction, the proposed analytes for the 2009 groundwater monitoring are listed in Table 3-3. Further discussion of the analyte list, by groundwater monitoring location type is given below. In addition to the recommended analytes, P4 will also take physical water quality parameters, described in greater detail in the FSP in Appendix A.

TABLE 3-3 2009 GROUNDWATER PROPOSED ANALYTE LIST		
Category	**Fraction**	**Analytes (Analytical Method)**
2008 monitoring wells and MMW009	Unfiltered	TDS (EPA 160.1)
	Unfiltered	TSS (EPA 160.2)
	Unfiltered	Al, Ba, Be, Fe, Mo, V (EPA 6010B)
	Unfiltered	Sb, As, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, Tl, U, Zn (EPA 6020A)
	Unfiltered	Hg (EPA 7471)
	Unfiltered	Gross alpha, gross beta (EPA 900)
	Filtered	Nitrogen - total nitrate-nitrite (EPA 353.2)
	Filtered	SO_4, Cl (EPA 300.0)
	Filtered	Ca, Fe, Mg, K, Na (EPA 6010B)
	Filtered	Alkalinity (EPA 310.2)
	Filtered	Hardness (SM2340B)
Direct push borehole wells and 2009 monitoring wells	Unfiltered	TDS (EPA 160.1)
	Unfiltered	TSS (EPA 160.2)
	Unfiltered	Al, Fe, V (EPA 6010B)
	Unfiltered	Cd, Cr, Mn, Ni, Se, Zn (EPA 6020A)
	Unfiltered	Gross alpha, gross beta (EPA 900)
	Filtered	Nitrogen - total nitrate-nitrite (EPA 353.2)
	Filtered	SO_4, Cl (EPA 300.0)
	Filtered	Ca, Fe, Mg, K, Na (EPA 6010B)
	Filtered	Alkalinity (EPA 310.2)
	Filtered	Hardness (SM2340B)
2007 & older monitoring wells	Unfiltered	Se (EPA 6020A)
	Filtered	SO_4 (EPA 300.0)
	Unfiltered	TDS (EPA 160.1)
Seeps, springs, and streams	Unfiltered	TDS (EPA 160.1)
	Unfiltered	Cd, Se (EPA 6020A)
	Unfiltered	V (EPA 6010B)
	Filtered	Cd (EPA 6020A)
	Filtered	Ca, Mg (EPA 6010B)
	Filtered	SO_4, Cl (EPA 300.0)
Notes: Major ions are Ca, Fe, Mg, K, and Na Hardness is calculated on filtered fractions of Ca and Mg		

2008 monitoring wells and MMW009

- Expanded analyte list (see Table 3-3). The expanded analyte list as presented in Table B-3 from Appendix B, *2008 Phase IIb Monitoring Well Installation Technical Memorandum - Final,* dated April 2008 (MWH, 2008) with the exception of orthophosphate and ferrous/ferric iron. A copy of this table is included below.

Direct push borehole wells and 2009 monitoring wells

- Regular analyte list (see Table 3-3). The regular analyte list is the non-asterisked analytes presented in Table B-3 from Appendix B, *2008 Phase IIb Monitoring Well Installation Technical Memorandum - Final*, dated April 2008 (MWH, 2008) with the exception of orthophosphate and ferrous/ferric iron. However, chromium will also be included in the analyte list for these borehole wells. In addition, as noted above, metals analysis will be analyzed from the unfiltered, total fraction, unless excessive turbidity is encountered in the well.

2007 & older monitoring wells

- The results of the screening presented above in Table 3-2 for pre-2008 monitoring wells show exceedances for Cd, Ni, Se, SO4, TDS, and V when evaluated against primary and secondary screening benchmarks. Due to low numbers of exceedances in Cd, Ni, and V, as well as low factors of exceedance, P4 proposes to drop these analytes from the analytical suite (see Table 3-3). In addition, major ions are not included in the analytical suite since data has been collected for geochemical typing of these wells.

Production, Agricultural, and Domestic Wells

- None

Dump seeps, springs, and streams

- The seep, spring, and stream analytes are selected based on the results in Table 3-2. Only five analytes showed any exceedances after primary and secondary screening. Total and dissolved fractions at seeps, springs, and streams will be analyzed because these locations can also be evaluated as surface water (see Table 3-3). Stream stations MST144 and MST069 will be sampled under both the groundwater and surface water program. This will require that the stations be sampled for slightly different suites and different fractions of analytes as required by both programs.

From Appendix B, *2008 Phase IIb Monitoring Well Installation Technical Memorandum – Final:*

Table B-3
2008 Groundwater Analytes for Existing Wells

Parameter	Method	EDL	Reporting Units	Holding Time (days)
alkalinity, total	SM2320B	2	mg/L	14
aluminum	M200.7 ICP	0.03	mg/L	180
antimony*	M200.8 ICP/MS	0.0004	mg/L	180
Arsenic*	M200.8 ICP/MS	0.0001	mg/L	180
Barium*	M200.7 ICP	0.0001	mg/L	180
beryllium*	M200.7 ICP	0.0001	mg/L	180
cadmium	M200.8 ICP/MS	0.0001	mg/L	180
calcium	M200.7 ICP	0.2	mg/L	180
chloride	M300.0	0.5	mg/L	28
chromium*	M200.8 ICP/MS	0.0001	mg/L	180
cobalt*	M200.7 ICP	0.01	mg/L	180
copper*	M200.7 ICP	0.01	mg/L	180
gross alpha	M900.0	2	pCi/L	180
gross beta	M900.0	4	pCi/L	180
hardness	Calculation	1.5	mg/L	-
iron	M200.7 ICP	0.01	mg/L	180
ferrous iron, dissolved (Field)	HACH	0.01	mg/L	-
ferric iron, dissolved	Calculation	0.01	mg/L	-
lead*	M200.8 ICP/MS	0.0001	mg/L	180
manganese	M200.8 ICP/MS	0.0005	mg/L	180
magnesium	M200.7 ICP	0.2	mg/L	180
mercury*	M245.1	0.0002	mg/L	28
molybdenum*	M200.7 ICP	0.01	mg/L	180
nickel	M200.8 ICP/MS	0.0006	mg/L	180
Nitrogen (total nitrate-nitrite)	M 353.2	0.02	mg/L	28
orthophosphate	M 365.1	0.005	mg/L	28
pH	M150.1	0.1	pH	-
potassium	M200.7 ICP	0.3	mg/L	180
selenium	SM3114 B, AA-Hydride	0.001	mg/L	180
silver*	M200.7 ICP	0.01	mg/L	180
sodium	M200.7 ICP	0.3	mg/L	180
sulfate	M300.0	0.5	mg/L	28
thallium*	M200.8 ICP/MS	0.0001	mg/L	180
total dissolved solids+	M160.1	10	mg/L	7
total suspended solids+	M160.1	10	mg/L	7
uranium*	M200.8 ICP/MS	0.0001	mg/L	180
vanadium	M200.8 ICP/MS	0.0002	mg/L	180
zinc	M200.8 ICP/MS	0.002	mg/L	180

* -- Analytes to be analyzed only in groundwater collected from monitoring wells MMW007, MMW009, MMW010, MMW012, MMW014, MMW017, and MMW018, and surface water at sites not previously sampled for the expanded list of analytes.
+ -- Analyte to be analyzed only in groundwater collected from monitoring well MMW009 and 5% of these monitoring wells: MMW001, MMW004, MMW009, MMW011, MMW013, MMW014, MMW017, MMW019, MMW020, and MMW022.
bicarbonate and carbonate to be analyzed only in groundwater collected from monitoring wells used for geochemical typing.
Methods are for media (non-blank) samples.
Equipment and field blanks will be analyzed for unfiltered results. For regulatory compliance, all media samples will be analyzed for unfiltered metals.
EDL – Estimated Detection Limit; the laboratory analytical limit does not reflect possible sample-specific elevation of the reporting limit due to dilution, contamination or other issues identified during the data validation process.

3.3.3 Seasonal Sampling Evaluation

Based on A/T direction, P4 evaluated the spring and fall selenium and sulfate data collected in 2004, 2007, and 2008 at the spatially relevant locations. These data are presented below in Table 3-4, *Summary of Selenium and Sulfate Concentrations and Seasonal Sampling Evaluation*. This evaluation supported the decision to sample some stations in the fall as well as the spring. Sites for fall sampling were retained based on the following: (1) higher selenium or sulfate concentrations in the fall compared to the spring, (2) selenium or sulfate concentrations greater than the applicable groundwater quality standard, (3) lack of historical fall sample data, and (4) increasing concentrations trends. The following locations will be sampled in fall 2009 based on the rationale provided below:

1) Historic samples results are higher in the fall than the spring and exceed either the selenium or sulfate water quality criteria:

- MDS026
- MDS030
- MMW010
- MMW013
- MST069

2) Fall samples results have never been collected and available spring data samples exceed the selenium or sulfate water quality criteria:

- MDS025
- MDS034
- MST144

3) Historic samples results are higher in the fall than the spring but are below either the selenium or sulfate water quality criteria:

- MSG004

In addition, MST069 will be sampled under both the surface water and groundwater monitoring programs.

It is also noted that if the pending spring 2009 data is significantly lower than the fall 2008 data for wells installed in 2008, then additional wells (e.g., MWM027 and MWM029) will be included in the fall sampling program. In addition, future evaluations will consider whether wells or other groundwater sampling locations exceed the groundwater quality criteria. These locations may also be included in future fall sampling events.

TABLE 3-4 SUMMARY OF SELENIUM AND SULFATE CONCENTRATIONS AND SEASONAL SAMPLING EVALUATION												
Location	Spring 2004		Fall 2004		Spring 2007		Fall 2007		Spring 2008		Fall 2008	
	Se	SO_4	Se	SO_4	Se	SO_4	Se	SO_4	Se	SO_4	Se	SO_4
	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
MDS025	0.016	590			0.056	838						
MDS026	0.43	810	0.006	3	0.157	786	0.019	850	0.19	582	0.0190	733
MDS030	0.52	144	0.57	15.3	0.73	164	0.92	91	0.45	129	0.893	172
MDS034									0.14	183		
MMW001		99.6		100			0.028	117				
MMW002		53.6		49.3								
MMW003		81.3		123								
MMW004		137		137			0.002	129	0.002	125	0.0025	116
MMW006							0.08	60.7	0.069	59.1	0.0733	58.4
MMW007							0.002	21	0.005	8.8	0.0024	55.1
MMW008							0.005	9.2	0.005	35.9	0.0014	29.6
MMW009							0.001	87.7	0.005	62.8	0.0012	55.8
MMW010							0.005	36.7	0.1	367	0.0182	547
MMW011							0.005	98.4	0.005	96.1	0.0009	89
MMW013							0.005	274	0.051	332	0.0909	273
MMW014							0.005	35.8	0.005	61.9	0.0020	36.9
MMW017							0.13	461	0.103	452	0.101	447
MMW018							0.03	48.6	0.027	60.4	0.0274	50.2
MMW019							0.005	159	0.004	93.5	0.0006	159
MMW020							0.017	127	0.01	131	0.0088	113
MMW021							0.047	50	0.049	44.6	0.0495	45.2
MMW022							0.018	245	0.017	263	0.0175	239
MMW023							0.003	211	0.004	222	0.0039	214
MMW024											0.0139	192
MMW025											0.0009	9.66
MMW026											0.0013	19.5
MMW027											0.314	229
MMW028											0.0026	68

TABLE 3-4 SUMMARY OF SELENIUM AND SULFATE CONCENTRATIONS AND SEASONAL SAMPLING EVALUATION												
Location	Spring 2004		Fall 2004		Spring 2007		Fall 2007		Spring 2008		Fall 2008	
	Se	SO_4	Se	SO_4	Se	SO_4	Se	SO_4	Se	SO_4	Se	SO_4
	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
MMW029											0.806	547
MMW030											0.0010	15
MMW031											0.0009	3.21
MSG004	0.016	33.5	0.031	46	0.015	29.1			0.005	26.6	0.0135	37.2
MSG005	0.007	34.4	0.004	30	0.007	35.9	0.002	23.3	0.015	33.8	0.0050	30.1
MSG006	0.22	390	0.28	438	0.26	602	0.018	215	0.098	354	0.0234	299
MSG007					0.003	62.4	0.003	1810	0.02	63.1	0.0131	72.1
MST069					1.1	1290	0.034	1340	0.87	990	1.2	1200
MST096	0.02	100	0.027	59.4					0.031	96.1	0.0302	92.5
MST136	0.016	143							0.021	40.5		
MST144	0.229	340							0.21	196		

Notes:
Units in mg/L
Station will be sampled in the spring and fall 2009.
Station will be considered for sampling in fall 2009 based on spring 2009 results (i.e., if spring results are lower than fall results)

4.0 REFERENCES

IDEQ, 2008. *Re: List of Analytes to Sample for Fall 2008 Sampling Event*. Letter from M. Rowe (IDEQ) to B. Koch (P4). 16 September 2008.

MWH, 2004a. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. March.

MWH, 2004b. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Project Field Sampling Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. April.

MWH, 2004c. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Quality Assurance Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. April.

MWH, 2004d. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Health and Safety Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. April.

MWH, 2004e. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Field Sampling Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. April.

MWH, 2008. *2008 Phase IIb Monitoring Well Installation Technical Memorandum – Final Revision 2*. April 2008.

MWH, 2009a. *2007 & 2008 Data Summary Report —Draft*. Prepared for P4 Production. March 2009.

MWH, 2009b. *2009 & 2010 Surface Water Monitoring Sampling and Analysis Plan—Draft*. Prepared for P4 Production. April 2009.

MWH, 2009c. *Health and Safety Plan – Inactive Mines Site Investigation – Draft*. Prepared for P4 Production. April 2009.

MWH, 2009d. *Quality Assurance Project Plan Addendum Program Quality Assurance Plan - Final*. Prepared for P4 Production. May 2009.

P4, 2009. *Direct Push Groundwater Continuation Sampling and Analysis Plan*. April 2009.

USEPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4*. U.S. Environmental Protection Agency, Washington DC, EPA/240/B-06/001.

USEPA, 2008. *EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites*. U.S. Environmental Protection Agency, Washington DC, (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, 12 September 2008).

APPENDICES

APPENDIX A – FIELD SAMPLING PLAN

2009 GROUNDWATER MONITORING

FIELD SAMPLING PLAN

FINAL
Revision 3

August 10, 2009

TABLE OF CONTENTS

1.0 INTRODUCTION..1-1
2.0 PROGRAM BACKGROUND AND OBJECTIVES..2-1
3.0 SAMPLE LOCATIONS, FREQUENCY, AND SCHEDULE...3-1
4.0 SAMPLE COLLECTION AND ANALYSIS..4-1
4.1 SITE ACCESS, LOGISTICS, AND SAFETY 4-1
4.2 GROUNDWATER COLLECTION 4-1
4.2.1 Surface Expressions of Groundwater (SEGW)..4-1
4.2.2 Monitoring Wells..4-2
4.3 FIELD PARAMETER MEASUREMENTS..4-5
4.4 SEGW FLOW MEASUREMENTS...4-6
4.5 WATER LEVEL DATA LOGGER RETRIEVAL 4-6
4.6 BOREHOLE MONITORING WELL DEVELOPMENT 4-6
4.7 SAMPLE DESIGNATION..4-6
4.8 SAMPLE HANDLING AND SHIPPING 4-7
4.9 SAMPLE ANALYSIS 4-8
4.10 SAMPLING QUALITY ASSURANCE 4-9
5.0 PROJECT ORGANIZATION..5-1
5.1 PROJECT TEAM...5-1
5.2 PROJECT SCHEDULE 5-2
5.3 PROJECT DELIVERABLES 5-2
6.0 REFERENCES...6-1

LIST OF TABLES

Table 3-1 Groundwater Monitoring Locations, Frequency, and Schedule……………....3-2
Table 4-1 Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times………………………………………………………..4-4
Table 4-2 Calibration and Maintenance Requirements for Field Equipment…………….4-5
Table 4-3 Groundwater Analytes……………………………………………………..4-8
Table 4-4 Sample Tracker for 2008 Monitoring Wells and MMW009………………….4-11
Table 4-5 Sample Tracker for Direct Push Borehole Wells and 2009 Monitoring Wells.4-12
Table 4-6 Sample Tracker for 2007 & Older Monitoring Wells………………………...4-14
Table 4-7 Sample Tracker for Seeps, Springs, and Streams……………………………4-16
Table 5-1 Project Contacts……………………………………………………………...5-2

LIST OF DRAWINGS

Drawing 1 Groundwater Sampling Locations

ATTACHMENTS

Attachment 1 Standard Operating Procedures

ACRONYMS AND ABBREVIATIONS

A/T	Agencies and Tribes
BW	Borehole Monitoring Well
DQOs	Data Quality Objectives
e.g.	*exempli gratia* (Latin, for example)
FSP	Field Sampling Plan
FTU	Formzin Turbidity Unit
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
i.e.	*id est* (Latin, that is to say; in other words)
HDPE	high-density polyethylene
mg/L	Milligrams per Liter
MWH	MWH, Inc. (formerly Montgomery Watson Harza, Inc.)
P4	P4 Production, L.L.C.
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and Analysis Plan
SEGW	Surface Expression of Groundwater
SOP	Standard Operating Procedure
SW	Surface Water

1.0 INTRODUCTION

This Field Sampling Plan (FSP) details the work scope for groundwater monitoring at existing groundwater stations around P4's Ballard, Henry, and Enoch Valley Mines. Groundwater stations include monitoring wells, direct push pre-pack wells, and surface expressions of groundwater (SEGW) such as springs and seeps. Direct push program borehole monitoring wells (BWs), to be installed in 2009, will be sampled concurrently with this effort, but the reader is directed to the *Direct Push Groundwater Continuation Sampling and Analysis Plan* (P4, 2009) for program and sampling details. This FSP is an attachment to the *2009 Groundwater Monitoring Sampling and Analysis Plan* (SAP). The SAP presents the Data Quality Objectives (DQOs) that have been developed to guide the monitoring program presented in this FSP. The complementary documents to the FSP are the *Quality Assurance Project Plan (QAPP) Addendum* (MWH, 2009b) and *Health and Safety Plan* (HSP). The QAPP and HSP are included by reference and this FSP is included as Appendix A of the SAP, respectively.

The FSP is organized as follows:

Section 1 – Introduction

Section 2 – Program Background and Objectives: provides a brief summary of information related to the need for continued groundwater monitoring, and information on the available historic data as well as the sampling objectives and design rationale

Section 3 – Sample Locations, Frequency, and Schedule: specifies the field sampling and analysis activities

Section 4 – Sample Collection and Analysis: summarizes protocols for all sample collection and handling procedures and sample analyses and laboratory methods

Section 5 – Project Organization: presents the project team, schedule, and deliverables

Section 6 – References

2.0 PROGRAM BACKGROUND AND OBJECTIVES

This section provides brief background information related to groundwater monitoring for the Ballard, Henry, and Enoch Valley Mines. Additional program background details may be obtained from the *2004 Site Investigation Work Plans* (MWH, 2004), the *Draft 2007 and 2008 Data Summary Report Mines Site Investigation* (MWH, 2009a), and the *Conditional Final - 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models - Interim Report for Hydrogeologic Investigation* (MWH, 2008).

Characterization of groundwater at the Sites has been ongoing since 2004. The *Draft 2007 and 2008 Data Summary Report* (MWH, 2009a) provides a summary of the most recent groundwater characterization results. As noted in the SAP, ongoing monitoring of COPC concentrations and piezometric conditions in monitoring wells and specific seeps and springs is needed to complete characterization of the nature and extent of selenium in groundwater. The groundwater data collected under this plan will also support the evaluation of surface water/groundwater interaction and refinement of the hydrogeologic conceptual models of the Sites. Sampling stations, analytical parameters, and monitoring frequency have been reevaluated to ensure that they are complementary to the aforementioned objectives. This rationale as well as the screening and evaluation are documented in Section 3.0 of the SAP.

3.0 SAMPLE LOCATIONS, FREQUENCY, AND SCHEDULE

This section describes the groundwater monitoring program sampling locations and frequencies. The sampling locations and frequencies are summarized programmatically below in Table 3-1, *Groundwater Sampling Locations, Frequency, and Schedule*. The locations of the sampling stations are shown in Drawing 3-1, *Groundwater Sampling Locations*. These sampling locations were screened according to the rationale in Section 3.0 of the SAP.

TABLE 3-1 GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE							
Mine	Station Description	Location		Station	Station	2009	
		Latitude	Longitude	Number	Type	Spring	Fall
Ballard	Short Creek	42 49 04.15	111 29 25.80	MBW006	BW	x	
	Blackfoot River Road @ Monsanto Haul Road	42 49 12.96	111 29 48.71	MBW009	BW	x	
	Ballard Creek	42 49 23.46	111 29 38.93	MBW011	BW	x	
	Ballard, Western Shallow	42 50 01.91	111 29 54.83	MBW026	BW	x	
	Ballard, Western Deeper	42 50 02.23	111 29 54.34	MBW027	BW	x	
	Torgeson	42 49 34.44	111 29 42.93	MBW028	BW	x	
	Holmgren	42 49 33.92	111 28 11.14	MBW032	BW	x	
	Wooley Valley Creek	42 50 03.76	111 27 56.21	MBW048	BW	x	
	Ballard Mine, Pit #2 Upper Dump Seep	42 49 43.00	111 29 22.00	MDS030	DS	x	x
	South of West Ballard Pit; south of waste rock dumps	42 49 20.0	111 29 03.0	MMW006	MW	x	
	Northwest of Ballard Mine into Long Valley Creek alluvial flow field	42 49 59.6	111 29 47.4	MMW017	MW	x	
	East of Ballard Mine in Wooley Valley alluvial flow field	42 49 39.4	111 28 04.5	MMW018	MW	x	
	East side of West Ballard Pit (MMP035); replacement of MMW001	42 49 36.4	111 29 03.3	MMW020	MW	x	
	West side of West Ballard Pit (MMP035); replacement of MMW002	42 49 35.6	111 29 23.9	MMW021	MW	x	
	East Ballard mine area in the vicinity of MMW018	42 49 37.78	111 28 08.74	MMW029	MW	x	
	Along the southwestern portion of Ballard Mine in the vicinity of MMW016A	42 49 10.72	111 29 17.03	MMW030	MW	x	
	Along the western perimeter of Ballard Mine in the vicinity and north of MMW017	42 50 11.87	111 29 43.05	MMW031	MW	x	
	Adjacent to MWD084	TBD	TBD	MMW032	MW		x
	Deeper well nested with MMW029	TBD	TBD	MMW033	MW		x
	West Ballard Mine near MST068	42 49 35.99	111 29 36.55	MW-15A	MW	x	
	Southwest Ballard Mine near MST069	42 49 08.83	111 29 16.53	MW-16A	MW	x	
	Ballard Mine, Holmgren Spring	42 49.3063	111 28.0794	MSG004	SG	x	x
	Ballard Mine, Cattle Spring	42 49.3277	111 28.0855	MSG005	SG	x	
	Ballard Mine, Southeast Spring	42 49 42.60	111 27 59.00	MSG006	SG	x	
	Ballard Mine, South of Southeast Spring	42 49 63.05	111 27 86.16	MSG007	SG	x	
	Short Creek below Ballard Mine	42 49 11.23	111 29 19.75	MST069	ST	x	x
	Tributary of North Fork Wooley Valley Creek, below Ballard Mine	42 49 30.00	111 27 45.00	MST096	ST	x	

TABLE 3-1 GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE							
Mine	**Station Description**	**Location**		**Station**	**Station**	**2009**	
		Latitude	**Longitude**	**Number**	**Type**	**Spring**	**Fall**
Henry	Henry Mine, Dump Seep #3 (new for 2008)	42 53 46.82	111 29.10.25	MDS034	DS	x	x
	North of Henry Mine north pit	42 54 07.7	111 29 46.5	MMW004	MW	x	
	Southeast of Center Henry Pit; near MPW023	42 52 22.3	111 27 51.3	MMW010	MW	x	x
	Northwest of Center Henry Pit; south of Little Blackfoot River	42 53 48.3	111 29 30.0	MMW011	MW	x	
	Southeast of Henry Mine center pit in Lone Pine Creek alluvial flow field	42 51 59.3	111 27 05.2	MMW014	MW	x	
	North of Henry Mine center pit	42 53 50.2	111 29 25.4	MMW019	MW	x	
	Northeast lobe of Henry Mine waste rock dump MWD086	42 53 09.2	111 28 18.3	MMW022	MW	x	
	Henry Mine North Pit	42 54 20.50	111 30 27.50	MMW023	MW	x	
	Near the Little Blackfoot River northwest of MMW019	42 53 50.24	111 28 60.00	MMW028	MW	x	
Enoch Valley	Rasmussen Creek	42 51 55.52	111 24 04.12	MBW085	BW	x	
	Rasmussen Road and Agrium Haul Road intersection	42 51 38.34	111 23 44.32	MBW087	BW	x	
	Agrium Haul Road North	42 51 57.08	111 23 28.14	MBW099	BW	x	
	Western Enoch Valley, East of fence	42 53 28.32	111 25 55.86	MBW107	BW	x	
	Western Enoch Valley ,West of fence	42 53 34.67	111 26 13.72	MBW112	BW	x	
	Enoch Valley Mine, West Dump Seep	42 52 12.50	111 24 11.50	MDS025	DS	x	x
	Enoch Valley Mine, South Dump Seep	42 51 48.70	111 23 35.70	MDS026	DS	x	x
	South of EVM South Dump; near edge of dump footprint	42 51 48.5	111 23 34.4	MMW007	MW	x	
	South of EVM South Dump; south and downgradient of MMW007	42 51 48.6	111 23 29.8	MMW008	MW	x	
	Central North Dump (MWD091)	42 53 34.6	111 25 33.8	MMW009	MW	x	
	Northwest of EVM North Dump in Lone Pine Creek alluvial flow field	42 53 28.75	111 25 53.34	MMW012	MW	x	
	Southwest of EVM in Rasmussen Creek alluvial flow field	42 52 05.7	111 24 12.0	MMW013	MW	x	x
	Along the south end of Enoch Valley Mine, near MMW013	42 52 11.73	111 24 11.86	MMW024	MW	x	
	Along the south end of Enoch Valley Mine, near MMW007	42 51 49.16	111 23 31.95	MMW025	MW	x	
	Northeast of MPW006/MMW008	42 51 56.48	111 23 25.75	MMW026	MW	x	
	Near MMW012	42 53 28.97	111 25 53.50	MMW027	MW	x	
	Deeper well nested with MMW013	TBD	TBD	MMW034	MW		x
	Deeper well nested with MMW027	TBD	TBD	MMW035	MW		x
	Well west of MMW027	TBD	TBD	MMW036	MW		x

TABLE 3-1 GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE							
Mine	**Station Description**	**Location**		**Station**	**Station**	**2009**	
		Latitude	**Longitude**	**Number**	**Type**	**Spring**	**Fall**
	Rasmussen Creek headwaters near Enoch Valley Mine Shop Pond	42 52 34.00	111 25 03.00	MST136	ST	x	
	West Pond Creek headwaters, below West Pond	42 52 16.07	111 24 18.67	MST144	ST	x	x

Notes:
Location (GPS) coordinates use the NAD27 datum and are presented in ddd mm ss.ss format (degrees minutes seconds).
TBD - To be determined
DS - Dump Seep
BW - Borehole Monitoring Well
SG - Spring
MW - Monitoring Well
ST - Stream

4.0 SAMPLE COLLECTION AND ANALYSIS

This section presents the site access requirements, equipment, and procedures for the collection, handling, and analysis of each surface water sample. Where applicable, references to SOPs in Attachment 1 are provided.

4.1 SITE ACCESS, LOGISTICS, AND SAFETY

P4 has access to all groundwater monitoring locations. The A/T will be notified, at minimum, five business days prior to commencement of field activities. The MWH Field Team Leader will notify the P4 Project Manager (Barry Koch) at minimum three days prior to working at a mine area. Such notification is necessary to allow time for site-specific safety training by P4, and if necessary, to arrange for a P4 representative to accompany the crew to provide access through locked gates. Relevant P4, agency, and other field contacts are provided in Section 5.0.

Field equipment and samples will be stored at the Fox Hills Ranch, owned by P4. Equipment, supplies, and samples will be shipped and received from the Monsanto plant, in Soda Springs, in care of Barry Koch, P4. Additional sample handling and shipping information is presented in Section 4.6.

Safety procedures for the site investigation are described in the HSP. Parts of the Enoch Valley Mine area are still active, and thus, Enoch Valley has its own safety requirements that will be followed by field personnel when working in, or traveling through, active areas of the Site. The mine-specific safety requirements involve a short training orientation for hazard recognition and avoidance provided by P4. In the event that any of P4's safety policies are stricter than the requirements of the HSP, those safety requirements will take precedence. Sampling teams will make every effort to sample locations in active areas of the mine outside of normal Monsanto operating hours (i.e., on Fridays, Saturdays, or Sundays).

4.2 GROUNDWATER COLLECTION

4.2.1 Surface Expressions of Groundwater (SEGW)

SEGW samples will be collected using the protocols outlined in SOP-NW-9.1, *Collection of Surface Water Samples*. This SOP is located in Attachment 1.

Surface water samples would normally be taken from streams using a Kemmerer horizontal water bottle sampler, either across the channel, or along the channel, as permitted. However SEGW samples are usually collected from stations at small streams, seeps, and springs and will be taken using a suitable polyethylene container, i.e., the 1-Liter bottle from the swing sampler or a suitable pitcher. Water samples will be transferred to appropriate sample containers after collection and any required filtering.

Unfiltered, acidified samples will, as needed, be collected and analyzed for total metals. Filtered, acidified samples will, as needed, be collected and analyzed for "dissolved" metals. Filtered samples will be filtered in the field using a new 0.45-micron disposable filter at each sample location. Filtered and unfiltered, unacidified samples will also be collected for major ions and alkalinity. Parameters to be analyzed for are described in Section 4.9. Refer to Table 4-1, *Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times* for analyte sample container requirements. Water samples will be collected upon arrival at the station, prior to field water quality and flow measurements, to ensure high-quality, undisturbed samples.

For sample documentation, digital photos must be taken at each sampling location. A minimum of two photos should be taken at each location, one facing downstream, and one facing upstream, as appropriate.

4.2.2 Monitoring Wells

Monitoring well samples will be collected using the protocols outlined in SOP-NW-5.3, *Collection of Groundwater Quality Samples* and the SOP *Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.* These SOPs are located in Attachment 1.

Upon arrival at a well, measurement of the static water level is required. Measurement of the static water level is performed using a electronic water level indicator. The same measuring point on the casing is used to ensure the measurements are consistent. For MWH field studies, the wellhead reference point will be at the top of casing (PVC) - north side. See SOP-5, *Groundwater Level Data Collection,* for more information.

Low-stress sampling techniques, in accordance with EPA protocol, will be used for sampling wells when possible. Low-stress sampling may not be possible in existing wells if dedicated, high-flow pumps are already installed, or if the required sampling equipment cannot access the well. Detailed sampling protocol is included in the SOP. The sampling protocol states requirements for water level stabilization and parameter stabilization. Bladder pumps for low-stress sampling will be set at least 20 feet (if possible) below the air-water interface in the well, and pumped through dedicated tubing to the surface. The wells will be purged in accordance with USEPA protocols, such that water from the formation will be transported from the aquifer to the surface with minimal agitation.

In the event that the well produces water at an extremely slow rate and excessive drawdown is occurring (> 0.30 feet), even at a pumping rate of 100 mL/min, then a "purge and sample" method shall be employed. Under these circumstances, wells must be purged dry one time and allowed to recharge to a minimum of 80% of the original water level, and then the sample will be drawn. Monitoring wells MMW007, MMW010, MMW025, and MMW030 may need this method used.

Unfiltered, acidified samples will, as needed, be collected and analyzed for total metals. Filtered, acidified samples will, as needed, be collected and analyzed for "dissolved" metals. Filtered samples will be filtered in the field using a new 0.45-micron disposable filter at each sample location. Filtered and unfiltered, unacidified samples will also be collected for major ions and alkalinity. Parameters to be analyzed for are described in Section 4.9. Refer to Table 4-1, *Requirements for Containers, Preservation*

Techniques, Sample Volumes, and Holding Times for analyte sample container requirements. Contrary to SW and SEGW station protocol, monitoring well samples will be collected last; after water level and parameter stabilization has occurred.

TABLE 4-1 REQUIREMENTS FOR CONTAINERS, PRESERVATION TECHNIQUES, SAMPLE VOLUMES , AND HOLDING TIMES					
Sample Container—Water Matrices	**Preservative**	**Parameter***	**Analytical Method**	**Sample Preparation Method**	**Maximum Holding Time (Days)**
250 mL HDPE	HNO_3 pH < 2	dissolved metals (field filtered)	EPA 6010B and 6020A	microwave-assisted acid digestion (3015 ICP-MS) or hot plate acid digestion (3005A ICP)	180
250 mL HDPE	HNO_3 pH < 2	total metals (unfiltered)	EPA 6010B and 6020A	microwave-assisted acid digestion (3015 ICP-MS) or hot plate acid digestion (3005A ICP	180
250 mL HDPE	HNO_3 pH < 2	hardness (dissolved)	SM 2340	calculated by the laboratory from dissolved calcium and manganese ICP metals results**	180
250 mL HDPE	≤ 6 °C	dissolved chloride and sulfate (field filtered)	300.0	none (direct analysis on ion chromatograph)	28
500 mL HDPE	≤ 6 °C	alkalinity (unfiltered)	310.2	none (direct analysis colorimeter)	14
250 mL HDPE	≤ 6 °C	total dissolved solids (unfiltered)	160.1	desiccation	7
250 mL HDPE	HNO_3 pH < 2	total suspended solids (unfiltered)	160.2	desiccation	7
250 mL HDPE	H2SO4 pH <2	dissolved nitrogen (total nitrate-nitrite) (field filtered)	353.2	none (direct analysis colorimeter)	28
2000 mL HDPE	HNO_3 pH < 2	gross alpha/beta (unfiltered)	900.0	desiccation	180

Notes:
*Refer to Table 4-3, *Groundwater Analytes*, for groundwater parameters and methods.
** Per SM2340B, hardness (mg equivalent CaCO3/L = 2.497 [Ca, mg/L] + 4.118 [Mg, mg/L]; concentrations for dissolved Ca and Mg determined by ICP.
HDPE – high-density polyethylene

4.3 FIELD PARAMETER MEASUREMENTS

SEGW field parameter measurements will be made in-situ whenever possible after the collection of the sample. If an in-situ measurement is not possible, then the measurement will be made streamside from a suitable container.

Monitoring well parameter measurements will be made using a flow-through cell, and readings will be recorded after parameter stabilization has occurred. Refer to the *Low Stress Purging* SOP for stabilization requirements.

Field parameter values will be recorded on field data forms and in field notebooks. The following field water quality parameters will be measured:

- pH
- Conductivity
- Specific conductivity
- Temperature
- Dissolved oxygen
- Turbidity
- Oxidation-reduction potential

Field meters will be used in accordance with the manufacturer's instructions and calibration performed in accordance with Table 4-2, *Calibration and Maintenance Requirements for Field Equipment*. Conductivity, dissolved oxygen, turbidity, and pH meter performance will be calibrated each morning prior to field sampling and checked for accuracy before each station throughout the day. At the quality assurance/quality control (QA/QC) monitoring stations, all measurements will be taken three times.

TABLE 4-2
CALIBRATION AND MAINTENANCE REQUIREMENTS FOR FIELD EQUIPMENT*

Field Parameter	Required Procedure	Minimum Frequency	Required Equipment or Calibration Fluids
pH	2-point calibration	Each day prior to sampling	One pH buffer (7 pH), Reference Standard
Temperature	N/A	N/A	N/A
Dissolved Oxygen	Atmospheric calibration	Each day prior to sampling	Atmospheric oxygen with elevation
Conductivity	1-point reference	Each day prior to sampling	Reference Standard
ORP	1-point reference	Each day prior to sampling	Reference Standard
Turbidity	1-point calibration	Each day prior to sampling	Reference Standard
Flow	Velocity equivalence and spin test (Price meters) or equivalent	When the rotor is changed	Stopwatch, measuring tape

Notes:
*In the event of a discrepancy, the manufacturer's instruction manual shall take precedence.

4.4 SEGW FLOW MEASUREMENTS

Surface water flow rate measurements or estimates, if applicable, will be made from all SEGW monitoring locations listed programmatically in Table 3-1 of this FSP in conjunction with the collection of the water quality sample. Flow measurements will always be recorded after the SEGW water quality sample and field parameters have been collected to prevent potential contamination. Flow measurements will typically be measured with current meters using the velocity-area method (Rantz, 1982). For streams less than 0.2 feet deep, flow will be measured using a volumetric method, if possible. Details of surface water flow measurement methods are presented in SOP-NW-9.2a, *Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques*, which is located in Attachment 1.

4.5 WATER LEVEL DATA LOGGER RETRIEVAL

A Solinst Levelogger® data logger was installed in each well in the fall of 2008. The data loggers are recording water level, temperature, and time once each day. Field teams will download the data logger readings in spring and fall of 2009. Hydrographs of the readings will be provided in future reports.

4.6 BOREHOLE MONITORING WELL DEVELOPMENT

Borehole monitoring wells (BW stations) installed during the 2008 Direct Push program must be developed and must be done so before BW sampling can commence. For those BW stations that have not been developed, this effort will be conducted during this GW sampling event. Development protocol and details can be found in the *Direct Push Groundwater Continuation Sampling and Analysis Plan* (P4, 2009).

At BWs, constituents will be analyzed for the total fraction. However, if development is not successful, and turbidity fails to get below 5 Formazin Turbidity Unit (ftu), BW samples will be field filtered and the dissolved fraction will be reported.

4.7 SAMPLE DESIGNATION

Samples will be labeled with all necessary information on laboratory supplied labels using waterproof ink. At a minimum, each sample label shall contain the following information:

- Station identification
- Sample identification
- Date and time of sample collection, with sampler's initials
- Analyses required
- Filtered or unfiltered
- Method of preservation, if used
- Sample matrix

Each sample shall be assigned a unique identification number. This number shall be coded according to sample location according to the following format:

AABBGWMYYxxx-b-c

where:

- **AA** indicates the year (two digits) the sampling event started.
- **BB** indicates the month (two digits) the sampling event started.
- **GW** denotes that groundwater is sampled.
- **M** designates "M" for Monsanto and is used to differentiate from other sample stations identified by MWH for Idaho Mine Association (IMA) mine-specific investigations.
- **YY** denotes the station type; station type which is ST for streams, DS for dump seeps, SG for springs, MW for monitoring wells, and BW for borehole monitoring wells.
- **xxx** denotes the specific station number/location.
- **b** denotes the replicate number (no number shall indicate no replicate samples; if there are QA/QC replicate samples, then 1, 2 and 3 represent the replicate samples.
- **c** denotes whether the sample involved special field handling or is to be handled in a specific manner; handling codes are as follows:

  F: Filtered
  U: Unfiltered

As an example, sample number **0905GWMMW020-1-F** describes the first field replicate of a filtered groundwater sample collected at monitoring well MMW020 in May 2009.

4.8 SAMPLE HANDLING AND SHIPPING

Sample containers will be sealed in plastic bags with wire ties and immediately placed on ice in an insulated cooler to ≤ 6 °C. Insulated coolers will be provided by Microbac or purchased locally. All samples will be stored in the coolers and handled as specified in Section 2.0 of the *QAPP Addendum* (MWH, 2009b). All samples will remain in the coolers until the end of the day when all of the samples will be transferred to a locked refrigerator at the Fox Hills Ranch.

Samples will be shipped to Microbac with bagged wet ice in coolers secured with packing tape, via overnight Federal Express service to Microbac. MWH will fill out appropriate chain-of-custody forms; the chain-of-custody will be included with the sample shipment, and copies of all chains-of-custody along with Federal Express waybills will be kept by MWH field personnel.

All samples will be sent to Microbac at the following address:

Microbac
158 Starlite Drive
Marietta, OH 45750
(740) 373-4071
Attn: Kathy Albertson

Supplies including sample containers and coolers will be sent to the Monsanto Plant:

Monsanto Company
1853 HWY 34
Soda Springs, ID 83276
(208) 547-1439
Attn: Barry Koch

4.9 SAMPLE ANALYSIS

In spring and fall 2009, samples will be analyzed for the groundwater parameters presented in Table 4-3, *Groundwater Analytes*. The analyte list was developed based on recommendations from the A/T and the screening in Section 3.0 of the SAP. Microbac of Marietta, Ohio will analyze for all parameters listed.

TABLE 4-3
GROUNDWATER ANALYTES

Parameter	2008 MW's & MMW009	2007 & older MWs	BWs and 2009 MWs	Seeps , Springs, & Streams	Basis	Method	RL	Reporting Units	Holding Times (days)
alkalinity	x		x		total	310.2	10	mg/L	14
aluminum	x		x		total	6010B	0.1	mg/L	180
antimony	x				total	6020A	0.1	mg/L	180
arsenic	x				total	6020A	0.001	mg/L	180
barium	x				total	6010B	0.01	mg/L	180
beryllium	x				total	6010B	0.002	mg/L	180
cadmium				x	dissolved	6020A	0.0005	mg/L	180
cadmium	x		x	x	total	6020A	0.0005	mg/L	180
calcium	x		x	x	dissolved	6010B	0.2	mg/L	180
chloride	x		x	x	dissolved	300.0	0.2	mg/L	28
chromium	x		x		total	6020A	0.002	mg/L	180
cobalt	x				total	6020A	0.001	mg/L	180
copper	x				total	6020A	0.002	mg/L	180
gross alpha	x		x		total	900	5	pCi/L	180
gross beta	x		x		total	900	5	pCi/L	180

TABLE 4-3 GROUNDWATER ANALYTES									
Parameter	2008 MW's & MMW009	2007 & older MWs	BWs and 2009 MWs	Seeps , Springs, & Streams	Basis	Method	RL	Reporting Units	Holding Times (days)
hardness	x		x		dissolved	2340B-Calculation	5	mg/L	n/a
iron	x		x		dissolved	6010B	0.1	mg/L	180
iron	x		x		total	6010B	0.1	mg/L	180
lead	x				total	6020A	0.001	mg/L	180
manganese	x		x		total	6020A	0.002	mg/L	180
magnesium	x		x	x	dissolved	6010B	0.5	mg/L	180
mercury	x				total	7471	0.002	mg/L	28
molybdenum	x				total	6010B	0.01	mg/L	180
nickel	x		x		total	6020A	0.004	mg/L	180
nitrogen (total nitrate – nitrite)	x		x		total	353.2	0.05	mg/L	28
potassium	x		x		dissolved	6010B	1	mg/L	180
selenium	x	x	x	x	total	6020A	0.001	mg/L	180
silver	x				total	6020A	0.001	mg/L	180
sodium	x		x		dissolved	6010B	0.5	mg/L	180
sulfate	x	x	x	x	dissolved	300.0	1	mg/L	28
thallium	x				total	6020A	0.0002	mg/L	180
total dissolved solids	x	x	x	x	total	160.1	10	mg/L	7
total suspended solids	x		x		total	160.2	5	mg/L	7
uranium	x				total	6020A	0.040	mg/L	180
vanadium	x		x	x	total	6010B	0.01	mg/L	180
zinc	x		x		total	6020A	0.025	mg/L	180

Notes:
Method—Method to be utilized by Microbac
MW - Monitoring Well
BW – Direct-Push Borehole Well
RL—Reporting Limit of Microbac

4.10 SAMPLING QUALITY ASSURANCE

The following QA/QC procedures will be followed during surface water sampling:

- Collection of QA/QC samples will occur at a minimum rate of 10 percent of total stations.

- A QA/QC sample will consist of three field replicates.

- The equipment rinsate sample will be collected by rinsing decontaminated sampling equipment with deionized water in a manner similar to actual sample collection.

- The source water blank will be a sample of the deionized water used for the equipment rinsate sample.

- Equipment rinsate samples (ERs) will be taken on a daily basis whenever non-dedicated sampling equipment is used. For example, wells with dedicated pumps will not need an equipment rinsate sample taken. Source water blank samples should be collected once at the beginning of each sampling event, and whenever new source water is used. If more than one team collects samples on a given day, ERs will also be taken by each sampling team.

- For matrix spike analysis, field teams will collect additional volume and designate on the chain-of-custody forms that the samples are for matrix spike analysis. Matrix spike samples will be collected on a daily basis.

- All sampling equipment will be decontaminated prior to sample collection.

Refer to the *QAPP Addendum* (MWH, 2009b) for further details regarding surface water sampling QA/QC procedures. The QA/QC samples as well as a summary of all samples are provided on Tables 4-4 though 4-7.

Table 4-4
Sample Tracker for 2008 Monitoring Wells and MMW009

					Laboratory Parameters												Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Sb, As, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, Tl, U, Zn (SW6020A)	Total Al, Ba, Be, Fe Mo, V (SW6010B)	TDS (E160.1)	TSS (E160.2)	Hg (SW 7471)	Gross Alpha, Gross Beta (EPA 900)	Nitrate/nitrite as N (EPA 353.2)	Dissolved S04, Cl (EPA 300.0)	Dissolved Ca, Fe, Mg, K, Na (EPA 6010B)	Total Alkalinity (EPA 310.2)	Dissolved Hardness (SM2340B-Calc)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
0905GWMMW024-U	MMW024	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW024-F	MMW024	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW025-U	MMW025	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW025-F	MMW025	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW026-U	MMW026	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW026-F	MMW026	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW027-U	MMW027	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW027-F	MMW027	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW028-U	MMW028	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW028-F	MMW028	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW029-U	MMW029	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW029-F	MMW029	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW030-U	MMW030	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW030-F	MMW030	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW031-U	MMW031	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW031-F	MMW031	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW009-U	MMW009	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW009-F	MMW009	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMW15A-U	MW-15A	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMW15A-F	MW-15A	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMW16A-U	MW-16A	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMW16A-F	MW-16A	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
0905B-GW-10-U	na	Water		B	X	X	X	X	X	X																
0905B-GW-10-F	na	Water	X	B							X	X	X	X	X											
0905B-GW-11-U	na	Water		B	X	X	X	X	X	X																
0905B-GW-11-F	na	Water	X	B							X	X	X	X	X											
0905B-GW-12-U	na	Water		B	X	X	X	X	X	X																
0905B-GW-12-F	na	Water	X	B							X	X	X	X	X											
0905B-GW-13-U	na	Water		B	X	X	X	X	X	X																
0905B-GW-13-F	na	Water	X	B							X	X	X	X	X											
0905B-GW-14-U	na	Water		B	X	X	X	X	X	X																
0905B-GW-14-F	na	Water	X	B							X	X	X	X	X											

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2009 would have a prefix of (0906) followed by the normal sample ID.

Table 4-5
Sample Tracker for Direct Push Borehole Wells and 2008 and 2009 Monitoring Wells

					Laboratory Parameters											Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Cr, Mn, Se, Ni, Zn (SW6020A)	Total Al, Fe, V (SW6010B)	TDS (E160.1)	TSS (E160.2)	Gross Alpha, Gross Beta (EPA 900)	Nitrate/nitrite as N (EPA 353.2)	Dissolved S04, Cl (EPA 300.0)	Dissolved Ca, Fe, Mg, K, Na (EPA 6010B)	Total Alkalinity (EPA 310.2)	Dissolved Hardness (SM2340B-Calc)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
0905GWMBW006-U	MBW006	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW006-F	MBW006	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW009-U	MBW009	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW009-F	MBW009	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW011-U	MBW011	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW011-F	MBW011	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW026-U	MBW026	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW026-F	MBW026	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW027-U	MBW027	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW027-F	MBW027	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW028-U	MBW028	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW028-F	MBW028	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW032-U	MBW032	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW032-F	MBW032	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW048-U	MBW048	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW048-F	MBW048	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW085-U	MBW085	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW085-F	MBW085	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW087-U	MBW087	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW087-F	MBW087	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW099-U	MBW099	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW099-F	MBW099	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMBW107-U	MBW107	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW107-F	MBW107	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	

Table 4-5
Sample Tracker for Direct Push Borehole Wells and 2008 and 2009 Monitoring Wells

					Laboratory Parameters											Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Se, Cd, Cr, Mn, Ni, Zn (SW6020A)	Total Al, Fe, V (SW6010B)	TDS (E160.1)	TSS (E160.1)	Gross Alpha, Gross Beta (EPA 900)	Nitrogen (Total nitrate-nitrite) (EPA 353.2)	Dissolved S04, Cl (EPA 300.0)	Dissolved Ca, Fe, Mg, K, Na (EPA 6010B)	Total Alkalinity (EPA 310.2)	Dissolved Hardness (SM2340B-Calc)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
0905GWMBW112-U	MBW112	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMBW112-F	MBW112	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW032-U	MMW032	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW032-F	MMW032	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW033-U	MMW033	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW033-F	MMW033	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW034-U	MMW034	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW034-F	MMW034	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW035-U	MMW035	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW035-F	MMW035	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905GWMMW036-U	MMW036	Water		Primary	X	X	X	X	X								X	X		X	X	X	X	X	
0905GWMMW036-F	MMW036	Water	X	Primary						X	X	X	X	X			X	X		X	X	X	X	X	
0905B-GW-10-U	na	Water		B	X	X	X	X	X																
0905B-GW-10-F	na	Water	X	B						X	X	X	X	X											
0905B-GW-11-U	na	Water		B	X	X	X	X	X																
0905B-GW-11-F	na	Water	X	B						X	X	X	X	X											
0905B-GW-12-U	na	Water		B	X	X	X	X	X																
0905B-GW-12-F	na	Water	X	B						X	X	X	X	X											
0905B-GW-13-U	na	Water		B	X	X	X	X	X																
0905B-GW-13-F	na	Water	X	B						X	X	X	X	X											
0905B-GW-14-U	na	Water		B	X	X	X	X	X																
0905B-GW-14-F	na	Water	X	B						X	X	X	X	X											

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2009 would have a prefix of (0906) followed by the normal sample ID.

Table 4-6
Sample Tracker for 2007 and Older Monitoring Wells

					Lab Parameters				Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
09095GWMMW004-U	MMW004	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW004-F	MMW004	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW006-U	MMW006	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW006-F	MMW006	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW007-U	MMW007	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW007-F	MMW007	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW008-U	MMW008	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW008-F	MMW008	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW010-U	MMW010	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW010-F	MMW010	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW011-U	MMW011	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW011-F	MMW011	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW012-U	MMW012	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW012-F	MMW012	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW013-1-U	MMW013	Water		Triplicate	X	X				X	X		X	X	X	X	X	
09095GWMMW013-1-F	MMW013	Water	X	Triplicate			X			X	X		X	X	X	X	X	
09095GWMMW013-2-U	MMW013	Water		Triplicate	X	X				X	X		X	X	X	X	X	
09095GWMMW013-2-F	MMW013	Water	X	Triplicate			X			X	X		X	X	X	X	X	
09095GWMMW013-3-U	MMW013	Water		Triplicate	X	X				X	X		X	X	X	X	X	
09095GWMMW013-3-F	MMW013	Water	X	Triplicate			X			X	X		X	X	X	X	X	
09095GWMMW014-U	MMW014	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW014-F	MMW014	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW017-U	MMW017	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW017-F	MMW017	Water	X	Primary			X			X	X		X	X	X	X	X	
09095GWMMW018-U	MMW018	Water		Primary	X	X				X	X		X	X	X	X	X	
09095GWMMW018-F	MMW018	Water	X	Primary			X			X	X		X	X	X	X	X	

Table 4-6
Sample Tracker for 2007 and Older Monitoring Wells

					Lab Parameters				Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
0905GWMMW019-U	MMW019	Water		Primary	X	X				X	X		X	X	X	X	X	
0905GWMMW019-F	MMW019	Water	X	Primary			X			X	X		X	X	X	X	X	
0905GWMMW020-U	MMW020	Water		Primary	X	X				X	X		X	X	X	X	X	
0905GWMMW020-F	MMW020	Water	X	Primary			X			X	X		X	X	X	X	X	
0905GWMMW021-1-U	MMW021	Water		Triplicate	X	X				X	X		X	X	X	X	X	
0905GWMMW021-1-F	MMW021	Water	X	Triplicate			X			X	X		X	X	X	X	X	
0905GWMMW021-2-U	MMW021	Water		Triplicate	X	X				X	X		X	X	X	X	X	
0905GWMMW021-2-F	MMW021	Water	X	Triplicate			X			X	X		X	X	X	X	X	
0905GWMMW021-3-U	MMW021	Water		Triplicate	X	X				X	X		X	X	X	X	X	
0905GWMMW021-3-F	MMW021	Water	X	Triplicate			X			X	X		X	X	X	X	X	
0905GWMMW022-U	MMW022	Water		Primary	X	X				X	X		X	X	X	X	X	
0905GWMMW022-F	MMW022	Water	X	Primary			X			X	X		X	X	X	X	X	
0905GWMMW023-U	MMW023	Water		Primary	X	X				X	X		X	X	X	X	X	
0905GWMMW023-F	MMW023	Water	X	Primary			X			X	X		X	X	X	X	X	
0905B-GW-05-U	na	Water		B	X	X												
0905B-GW-05-F	na	Water	X	B			X											
0905B-GW-06-U	na	Water		B	X	X												
0905B-GW-06-F	na	Water	X	B			X											
0905B-GW-07-U	na	Water		B	X	X												
0905B-GW-07-F	na	Water	X	B			X											
0905B-GW-08-U	na	Water		B	X	X												
0905B-GW-08-F	na	Water	X	B			X											
0905B-GW-09-U	na	Water		B	X	X												
0905B-GW-09-F	na	Water	X	B			X											

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2009 would have a prefix of (0906) followed by the normal sample ID.

Table 4-7
Sample Tracker for Seeps, Springs, and Streams

					Laboratory Parameters							Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Se, Cd (SW6020A)	Total V (EPA6010B)	Dissolved Cd (EPA6020A)	Dissolved Cl, S04 (EPA 300.0)	Dissolved Ca, Mg (EPA 6010B)	Total Dissolved Solids (EPA 160.1)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
0905GWMSG004-U	MSG004	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMSG004-F	MSG004	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMSG005-1-U	MSG005	Water		Triplicate	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMSG005-1-F	MSG005	Water	X	Triplicate			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMSG005-2-U	MSG005	Water		Triplicate	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMSG005-2-F	MSG005	Water	X	Triplicate			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMSG005-3-U	MSG005	Water		Triplicate	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMSG005-3-F	MSG005	Water	X	Triplicate			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMSG006-U	MSG006	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMSG006-F	MSG006	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMSG007-U	MSG007	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMSG007-F	MSG007	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMDS025-U	MDS025	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMDS025-F	MDS025	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMDS026-1-U	MDS026	Water		Triplicate	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMDS026-1-F	MDS026	Water	X	Triplicate			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMDS026-2-U	MDS026	Water		Triplicate	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMDS026-2-F	MDS026	Water	X	Triplicate			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMDS026-3-U	MDS026	Water		Triplicate	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMDS026-3-F	MDS026	Water	X	Triplicate			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMDS030-U	MDS030	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMDS030-F	MDS030	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMDS034-U	MDS034	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMDS034-F	MDS034	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X

Table 4-7
Sample Tracker for Seeps, Springs, and Streams

					Laboratory Parameters							Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Se, Cd (SW6020A)	Total V (EPA6010B)	Dissolved Cd (EPA6020A)	Dissolved Cl, S04 (EPA 300.0)	Dissolved Ca, Mg, K, Na (EPA 6010B)	Total Dissolved Solids (EPA 160.1)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
0905GWMST069-U	MST069	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMST069-F	MST069	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMST096-U	MST096	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMST096-F	MST096	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMST136-U	MST136	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMST136-F	MST136	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905GWMST144-U	MST144	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
0905GWMST144-F	MST144	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
0905ER-GW-01-U	na	Water		ER	X	X				X											
0905ER-GW-01-F	na	Water	X	ER			X	X	X												
0905ER-GW-02-U	na	Water		ER	X	X				X											
0905ER-GW-02-F	na	Water	X	ER			X	X	X												
0905ER-GW-03-U	na	Water		ER	X	X				X											
0905ER-GW-03-F	na	Water	X	ER			X	X	X												
0905ER-GW-04-U	na	Water		ER	X	X				X											
0905ER-GW-04-F	na	Water	X	ER			X	X	X												
0905B-GW-01-U	na	Water		B	X	X				X											
0905B-GW-01-F	na	Water	X	B			X	X	X												
0905B-GW-02-U	na	Water		B	X	X				X											
0905B-GW-02-F	na	Water	X	B			X	X	X												
0905B-GW-03-U	na	Water		B	X	X				X											
0905B-GW-03-F	na	Water	X	B			X	X	X												
0905B-GW-04-U	na	Water		B	X	X				X											
0905B-GW-04-F	na	Water	X	B			X	X	X												

ER - equipment rinsate blank sample, to be taken once per field team per day from non-dedicated sampling equipment, total ERs taken may not add up to what is accounted for here

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2009 would have a prefix of (0906) followed by the normal sample ID.

5.0 PROJECT ORGANIZATION

5.1 PROJECT TEAM

The project team member information is presented below. Contact information for each member of the project team is presented in Table 5-1, *Project Contacts*. The field team leader will submit a daily update to P4 and MWH program managers that contains a report of daily progress, any variances from planned work for the day, anticipated work for the next day, and any other problems or assistance required. The field team leader will also perform a thorough review of the day's field sampling forms and update the tracker table according to the day's activities (i.e., stations sampled with sample ID's and field parameters taken). This process will procure an extra step in the QA/QC process to help ensure every sample is taken and that nothing is missed. All updates will be submitted via e-mail.

Groundwater Sampling Project Team:

- Barry Koch – P4 Program Manager
- Paul Stenhouse – P4 Environmental Regulatory Specialist
- Cary Foulk – MWH Project Manager
- Colin Duffy – Field Team Leader / Program Safety Officer
- Dean Brame – Assistant Field Team Leader / Field QC Manager
- Ruth Siegmund – Program Quality Manager
- Celeste Christensen – Program Control
- Elaine Smith – Database Manager
- Edmund Ling – Project Chemist
- Microbac – Contracted Analytical Laboratory
- Laboratory Data Consultants (LDC) – Contracted Third Party Validation

TABLE 5-1 PROJECT CONTACTS			
Company or Agency	**Contact**	**Title**	**Telephone**
P4 Production	Barry Koch	Special Project Lead—Mining / Program Manager	208-547-1439
	Bob Geddes	Environmental Regulatory Specialist / Management Support	208-547-1234
	Paul Stenhouse	Environmental Regulatory Specialist	208-547-1294
Idaho Department of Environmental Quality	Mike Rowe	Program Manager and On Scene Coordinator	208-236-6160
MWH	Cary Foulk	Program Manager and Supervising Geologist / Geochemist	970-879-6260
	Bill Wright	Technical Support and Principal Ecologist	425-241-7413
	Ruth Siegmund	Program Quality Manager	925-627-4756
	Colin Duffy	Field Team Leader / Program Safety Officer	425-896-6900
	Dean Brame	Assistant Field Team Leader / Field QC Manager	425-896-6900
	Suzanne Anderson	Analytical Task Manager and Technical & Field Support	425-896-6900
	Celeste Christensen	Project Coordinator	425-896-6900
	Edmund Ling	Project Chemist	925-627-4620
	Elaine Smith	Database Manager	925-627-4659
Microbac Laboratories, Inc.	Kathy Albertson	Project Manager (laboratory)	800-373-4071 x179
Laboratory Data Consultants, Inc	Linda Rauto	Project Manager (data validation subcontractor)	760-634-0437

5.2 PROJECT SCHEDULE

- Sampling – spring and fall 2009
- Data validation – within 60 days of receipt of laboratory data
- Data Summary Report – within 60 days of final, validated data set approval by the A/T or as agreed to for overall annual Data Summary Report.

5.3 PROJECT DELIVERABLES

The raw data and data validation reports will be submitted to the A/T when available. Once the validated sampling data are approved by the A/T, a Groundwater Sampling Data Summary Report will be submitted. This report will include:

- Field activity summary
- Data summary and detailed tables

- Figures presenting spatial distribution of data
- Statistical analysis of the data

This report may be incorporated within the overall Data Summary Report for the year's activities for the overall characterization project, or if the characterization component of the project is completed the data will be incorporated into the Site Investigation or Remedial Investigation report.

6.0 REFERENCES

MWH, 2004. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. March.

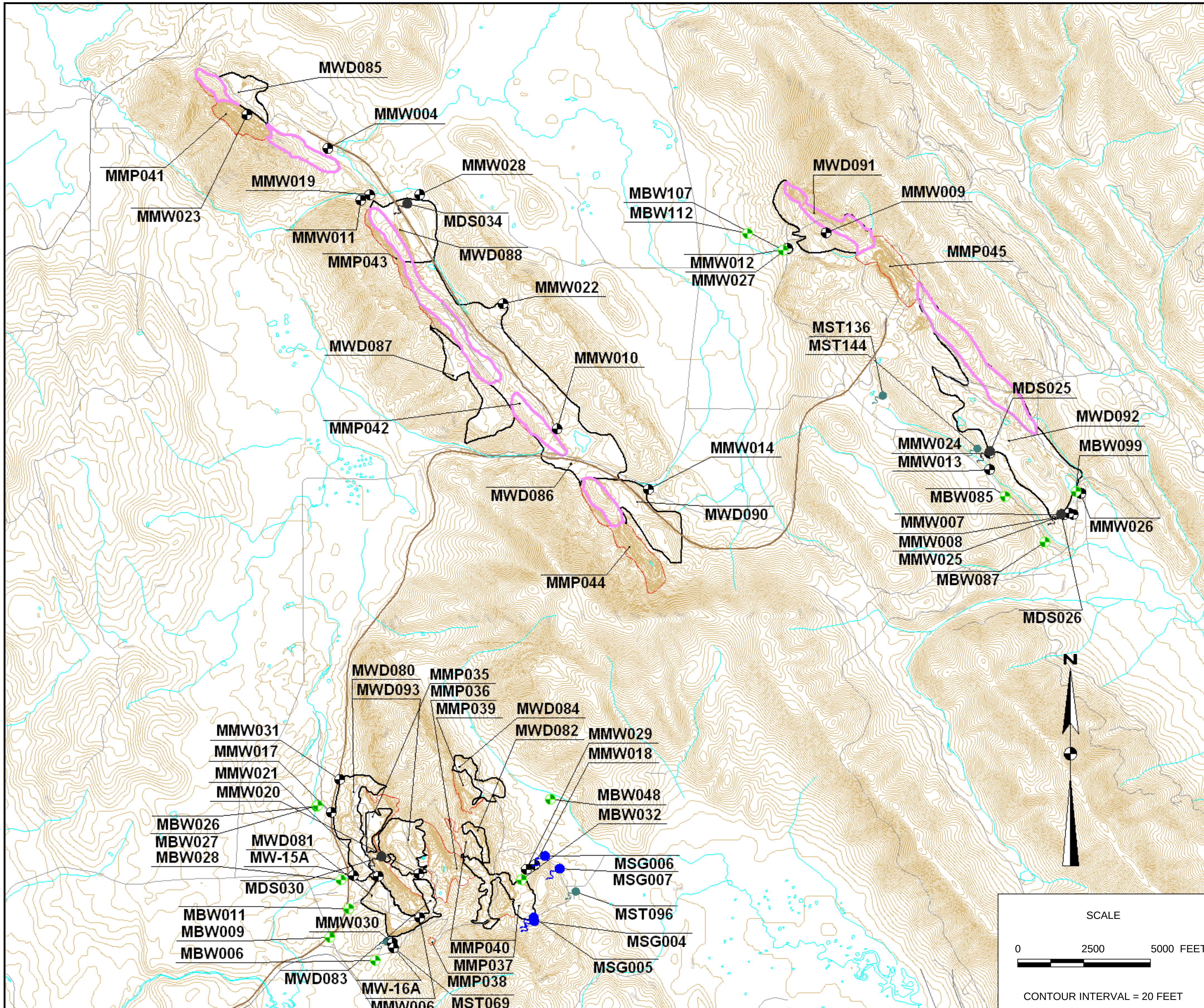
MWH, 2008. *Conditional Final - 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models - Interim Report for Hydrogeologic Investigation*. July.

MWH, 2009a. *Draft 2007 and 2008 Data Summary Report Mines Site Investigation*. Prepared for P4 Production. March.

MWH, 2009b. *Quality Assurance Project Plan Addendum Program Quality Assurance Plan*. Prepared for P4 Production. January.

P4, 2009. *Direct Push Groundwater Continuation Sampling and Analysis Plan*. April.

Rantz, S.E., et al. 1982. *Measurement and Computation of Streamflow: Volume 1; Measurement of Stage and Discharge*. Geological Survey Water-Supply Paper 2175. U.S. Government Printing Office. Washington, D.C.



LEGEND

CONTOURS — BACKFILLED PIT

CREEKS/RIVERS

ROADS — HAUL ROAD

WASTE ROCK PILE LOCATION (APPROXIMATE)

MINE PIT LOCATION (APPROXIMATE)

GROUNDWATER WELL MONITORING LOCATIONS

BOREHOLE MONITORING WELL

SPRING STATION

WASTE ROCK DUMP SEEP

STREAM STATION

MBW = BOREHOLE MONITORING WELL
MDS = DUMP SEEP
MMP = MINE PIT
MMW = MONITORING WELL
MSG = SPRING
MST = STREAM
MWD = WASTE ROCK DUMP

NOTES:

1. PRE-MINE TOPOGRAPHY ID FROM USGS DIGITAL; ELEVATION MODELS (DEM)-24K AND DIGITAL LINE GRAPHS (DLG) FOR HENRY, ID; WAYAN WEST, ID; CHINA HAT, ID; JOHNSON CREEK, ID; SODASPRINGS, ID; WAYAN EAST, ID; UPPER VALLEY, ID; DRY VALLEY ID AND LOWER VALLEY, ID.
2. PRE-MINE TOPOGRAPHY PROJECTION IS A MODIFIED IDAHO EAST STATE PLANE COORDINATE SYSTEM, NAD 27.

2	Draft	05/28	B. Massey	B. Massey	C. Foulk
REV	DESCRIPTION	DATE	DESIGNED BY	DRAWN BY	REVIEWED AND SIGNED BY

P4 PRODUCTION
SITE INVESTIGATION

PROJECT:
2009 GROUNDWATER MONITORING

DRAWING TITLE:
GROUNDWATER MONITORING LOCATIONS
BALLARD, HENRY, AND ENOCH VALLEY MINES

MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 1

ATTACHMENT 1

MWH
MONTGOMERY WATSON HARZA

SOP-NW-9.1

Collection of Surface Water Samples

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

The purpose of this document is to define the standard operating procedures (SOP) for the collection and handling of surface water samples. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of surface water sampling and is intended for use in conjunction with site-specific workplans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with approval of the Project Manager or Task Leader and the Quality Assurance (QA) Manager. Sampling locations shall be as specified in the governing workplan or SAP.

2.0 RESPONSIBILITIES

2.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager, as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements.

2.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

2.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, sediment sampling forms, generated data, and other associated and pertinent project information.

2.4 QA Manager

The QA Manager is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or workplans.

3.0 DISCUSSION

The methods described by this procedure may be used to acquire water samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

4.0 PROCEDURES

The sampling methods described in this SOP are suitable for collecting water samples that are located at or near active and historic phosphate mines in the southeast Idaho project area. This SOP describes collecting surface water samples at four different types of water bodies, streams, seeps, reservoir or lakes, and standing water locations (ponds). Sample documentation and labeling, as well as, sampling frequency, locations, volumes and analyses shall be as specified in the governing workplan or SAP.

4.1 Decontamination

Before sampling at a new location, all water sample collection equipment will be decontaminated by rinsing the water collection equipment three times with source water, or as specified in the governing workplan or SAP.

4.2 Instrument Calibration

Electronic equipment used during sampling to obtain field parameters will include, but is not limited to, a pH meter with automatic temperature compensation, a specific conductivity meter, a dissolved oxygen meter, a turbidity meter, and an oxidation-reduction potential meter (ORP or eH). Before going into the field, the field team leader will verify that all equipment is operating properly. Calibration, times and appropriate readings will be recorded in the field notebook and as specified in the governing workplan or SAP. Meters will be calibrated according to manufacturer's instructions.

4.3 Filtering

Samples to be analyzed for dissolved state will be filtered during the field sampling event by using a disposable 0.45 micron filter apparatus and peristaltic pump, vacuum pump, syringe, or equivalent equipment. Other samples for a particular analysis may require filtering as specified in the governing workplan or SAP. Filtered samples will be collected according to the following procedure:

- Assemble filter device according to manufacturer's instructions.
- Filter sample either by pouring sample in the top portion of filter unit or pumping it through an in-line filter using the pump or syringe.

- Transfer filtered sample to appropriate sample bottle with required preservative.

- Dispose of the used filter and tubing.

- Decontaminate any reusable filtering equipment. Place decontaminated equipment in a clean plastic bag or container for transportation between sampling locations.

4.4 Obtaining Water Samples

The following general procedures will be used before collecting surface water samples:

- Describe physical characteristics of the water source to be sampled, including type (seep, pond, stream, reservoir, lake, etc.), any visual discoloration of water, odor, clarity, or any other notable characteristic of the water source.

- Collect field measurements of water quality parameters.

- Assemble all necessary sample collection and filtering equipment.

- Make sure that the sample labels have been correctly filled out for the sampling location. Assemble bottles for filling.

- Decontaminate sample collection equipment by rinsing the equipment three times with source water.

- Collect water sample. Ideally, the sample will be taken from a point away from where the rinsing of collection equipment occurred when sampling standing water or upstream of the rinsing point when collecting flowing water. The water collection container will be lowered into the water, taking care to avoid collecting items floating in the water and disturbing any sediment during sample collection. After the container is filled, carefully lift it out of the water and empty it into a clean sample composite container. Repeat the process at the sampling location until a sufficient amount of sample has been placed into the composite container as described below. The amount of sample to be composited shall be as specified in the governing workplan or SAP.

- Transfer to appropriately labeled containers

4.4.1 Seeps

Water samples will be collected by immersing the sample transfer container as described above, or for a raw sample, the sample container in the water source. This collection method results in a grab sample that characterizes the medium at a point in space and time, and assumes that the water body sampled (seep) is homogeneously mixed and has no stratification. Water sample collection from seeps will be done closest to the point of discharge as possible, to minimize contamination from surficial contact.

4.4.2 Ponds

Water samples will be collected by immersing the sample transfer container as described above, or for a raw sample, the sample container in the water source. This collection method results in a grab sample that characterizes the medium at a point in space and time, and assumes that the water body sampled (pond) is homogeneously mixed and has no stratification due to it's small size. Collecting water samples from standing water will have the emphasis placed upon the sampler not to disturb the water to be sampled, and the use of a swing sampler to collect as far from the shoreline as possible. This method will be especially important when collecting samples from ponds that have loose material and high gradient slopes that define the pond shoreline, which is typical of mine pit ponds. This will also be important to minimize the immersion risk of sampling personnel. Water samples for ponds may be collected from any point along the shoreline.

4.4.3 Streams and Rivers

Samples will be collected from the same cross section of the stream as that which is used for the discharge (flow) measurement, if discharge is measured. Samples will always be collected prior to making discharge measurements. The sampler will stand downstream of the water to be sampled if safe to do so. If sampling multiple stations on the same stream, downstream samples will always be collected first. Prior to sampling, the stream will be observed for any upstream activities or events that may affect the sample quality. If such events are occurring, the sample will not be collected until the stream clears and the occurrence will be recorded in the field notes.

Selection of sampling methods and equipment based on flow conditions is as follows:

- If the stream is less than 10 ft wide, the sample will be collected from the center of the flow at mid-depth.

- If the stream is greater than 10 ft wide, one composite, consisting of three samples will be collected. The water samples will be taken at ¼, ½, and ¾ of the distance across the river or stream cross-section. These samples should be taken at mid-depth in the water column at each location across the stream channel. All three samples will be composited into one larger container, and apportioned as necessary, into the appropriate sample containers.

Water will be collected from smaller streams and rivers using a standard Kemmerer or Van Dorn horizontal water bottle sampler with the field technician standing downstream and to the side of the bottle. The sampler is a plastic cylinder with rubber stoppers that leave the ends open while being lowered to allow free passage of water through the cylinder. The Kemmerer horizontal water bottle sampler may need to be lowered on a line to reach the desired depth. Once the sampler reaches the desired depth, a 'messenger' is sent down the line, causing the stoppers to close the cylinder, which is then raised. In shallow and faster moving streams and rivers, operation of the Kemmerer horizontal water bottle sampler will be done by hand, and not with a ‘messenger’. The water inside the sampler will then be transferred to a clean composite container. The process will be repeated at the sampling location until a sufficient amount of sample has been placed into the composite container. When a sufficient amount has been collected, transfer the water from the composite container into the appropriate sample containers. If unsafe wadding conditions exist (i.e., deep water, fast flowing water, slippery surfaces, etc.) a swing sampler will be utilized instead of the horizontal water bottle sampler to collect sample water for compositing. The method of sample collection shall be recorded in the field notebook.

4.4.4 Reservoirs and Lakes

Each lake and/or reservoir sample consists of collecting and compositing samples at several depths along a vertical profile using a standard Kemmerer or Van Dorn horizontal water bottle sampler. This collection method results in a vertically composited sample that characterizes the medium at a point in space and time, and takes into account the possibility of the water body sampled (i.e., reservoir or lake) is not homogeneously mixed and may be stratified. The sampler is a plastic cylinder with rubber stoppers that leave the ends open while being lowered to allow free passage of water through the cylinder. Once the sampler reaches the desired depth, a ‘messenger’ is sent down the line to cause the stoppers to close the cylinder, which is then raised. The water inside the sampler will then be transferred to a clean composite container. Repeat the process at the sampling location until a sufficient amount of sample has been placed into the composite container. When a sufficient amount has been collected, transfer the water from the composite container into the appropriate sample containers. A boat shall be utilized to collect samples from reservoirs and lakes.

4.5 Sampling Documentation

A field sampling data sheet will be completed at each sample location. Items not applicable to the sampling will be labeled as not applicable (NA). Sampling information will also be recorded in a bound field notebook. The information recorded on the data sheet and in the field notebook will include the following:

- Sampling location
- Date and time of sampling
- Persons performing the sampling
- Field water quality parameter measurements (specific conductivity, temperature, dissolved oxygen, pH, oxidation-reduction potential, etc.)
- Physical description of the water body to be sampled (color, odor, etc.)
- Sample identification numbers
- Number of samples taken- note containers, analytes, filtering and preservation methods
- Identification numbers of any QC samples from the site
- Any irregularities or problems which may have a bearing on sample quality

4.6 Equipment List

Sample bottles and preservatives (ultra-pure or metal grade nitric acid) will be obtained from the laboratory selected to perform the chemical analyses of the samples. Extra sample bottles with appropriate preservatives will be obtained in case of breakage or other problems.

Equipment used during surface water sample collection includes:

- Camera
- Chain of custody
- Coolers with ice/blue ice
- Copy of this SOP, SOP-NW-9.2 and -9.2a (if applicable) and the governing workplan or SAP
- Dissolved oxygen meter
- Filtering apparatus with disposable 0.45 micron filters
- GPS unit
- Hand pump, peristaltic pump, vacuum pump, or equivalent equipment
- Oxidation-reduction potential meter
- Plastic HDPE sample pitcher
- Plastic squeeze bottle filled with distilled water
- Plastic trash bags
- pH/eH meter (with automatic temperature compensation)
- Rope if obtaining deep samples
- Rite-in-the-Rain™ field notebook
- Sample containers that are certified clean
- Sample labels
- Specific conductivity meter
- Strapping and clear tape
- Swing sampler
- Kemmerer or Van Dorn horizontal water bottle sampler
- Suitable HDPE 5 L container
- Turbidity meter
- Silicon tubing
- Wooden stakes
- Writing instruments
- Measuring tape

The governing workplan or SAP may require the use of other equipment based on the scope and objective of an individual project. Project personnel will review the workplan or SAP for any equipment not listed in this SOP.

4.7 Field Quality Assurance/Quality Control Samples

Field QA/QC sample requirements shall be as specified in the governing workplan or SAP.

4.8 Sample Containers

All sample bottles must be properly cleaned and prepared. Coordinate with selected analytical laboratory for appropriate sample bottle types and preparation requirements. Plastic, such as PVC, polyethylene, polypropylene, and Tygon, is an acceptable material for contacting samples when the analyses are for inorganic analytes (metals, radionuclides, anions, and cations). Stainless steel and fluorocarbon resin (Teflon, PTFE, FEP, HDPE, or PFA) are acceptable materials that may contact surface water samples. Glass is an acceptable material for contacting samples except when silica or fluoride analyses are to be performed.

4.9 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing workplan or SAP. Typical handling procedures for surface water samples are as follows:

- Store sample containers in coolers for transportation in compliance with the sample handling and chain of custody requirements specified in the workplan or SAP.

- Sample documentation and labeling requirements shall be as specified in the governing workplan or SAP.

All surface water samples shall be labeled and sealed and immediately placed in ice-filled coolers with securely closed lids for storage and transport. The analytical laboratory must receive samples in sufficient time to conduct the requested analyses within the specified holding time.

During surface water sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan, to minimize cross-contamination and to ensure the safety of the field sampling personnel.

SURFACE WATER SAMPLE COLLECTION FORM

Project:____ **Project Number:** ________________

Date: ______/_____/______ **Time:** ______________

Field Personnel: __________________________ **Signatures:** __________________________

__________________________ __________________________

SITE DESCRIPTION

Site Location: ____ **Elevation**_________________

Station Number: _______ **Photo No.:** ________________ **Roll No.:** ___________

GPS Coordinates: **Latitude**______°_______´_______´´ **Longitude**______°_______´_______´´

Comments/Descriptions:____

FIELD DESCRIPTION

Sample Identification Number: ____

Surface Water Characteristics (color, odor, appearance): __________________________________

____

Collection Method: **Grab, Kemmerer**____

Field Measurements

Parameter	Reading/Measurement			Initials	Remarks
	Sample 1	Sample 2	Sample 3		
Air Temperature (°C or F)					
Specific Conductivity (mhos) @ 25° C					
Conductivity					
Dissolved Oxygen (mg/L)					
pH					
Oxidation-Reduction Potential (ORP)					
Turbidity (FTU)					
Water Temperature (°C)					

MWH
MONTGOMERY WATSON HARZA

SOP-NW-9.2a

Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

This Standard Operating Procedure (SOP) provides general techniques for obtaining valid, representative flow measurements from natural open-channels using estimation techniques or man-portable devices. Direct methods for flow measurements in open channels using weirs, flumes, or other devices and direct and indirect flow measurements in pipes are provided in SOP-NW-9.2, *Surface Water Flow Measurements.* This SOP applies to any work performed by MWH or subcontractor personnel for any portion of stream flow measurements and is intended to be used in conjunction with governing work plans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approved by the Project Manager or Task Leader and the Quality Assurance (QA) Manager.

Stream flow measurement methods in this SOP assume the following conditions:

- No control structures will be used for flow measurements at surface water stations;
- A current meter will be the preferred method for discharge measurements; and
- A few locations may be appropriate for engineering estimates or volumetric measurement.

2.0 DEFINITIONS

Discharge is defined as the volume rate of flow of water, expressed in cubic feet per second (cfs), including any substances suspended or dissolved in the water. Methods for measuring discharge are based on a variety of flow conditions. Many discharge measurement methods are required because flow conditions differ from site to site.

3.0 RESPONSIBILITIES

3.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for field testing, total and accurate completion of data sheets, and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements.

3.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that stream flows are measured as specified in project work documents and this technical procedure.

3.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, surface water flow measurement forms, generated data, and other associated and pertinent project information.

3.4 QA Manager

The QA Manager is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or work plans.

4.0 DISCUSSION

The methods described by this procedure may be used to measure flow in open channels. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or work plans.

Because of the dynamic nature of surface water behavior, flow measurement by the methods described in this document may, on occasion, be impossible at some sites. It is understood that if unmeasurable flow conditions are encountered at any of the surface water data collection sites which are to be measured in this program, the field team will attempt to measure flow at a point upstream or downstream of the site and will note this point relative to the marked data collection point in the field logbook. Whether or not a measurement is made, the team will note the conditions that inhibited accurate flow measurement. This situation will be brought to the attention of the MWH Project Manager and QA Manager using the field change protocol established in the governing workplan or SAP.

5.0 PROCEDURES

5.1 Velocity-Area Method

Surface flow in stream channels that are greater than one foot wide, or where flow is estimated to exceed 2.0 cfs, will be measured by using the traditional stream gaging technique, the velocity-area method.

When using the velocity-area method to perform discharge measurements of flowing surface water streams, a current meter will be used. The most common current meters are vertical axis meters, such as the Price meter Type AA, and horizontal axis or propeller-type meters. The standard Price meter has a rotor 5 inches in diameter and 2 inches high with six cone-shaped cups mounted on a stainless steel shaft. A pivot bearing supports the rotor shaft. In addition to the type AA meters, a Price pygmy meter is used in shallow depths. The pygmy meter is scaled two-fifths as large as the standard meter and has no tailpiece. Propeller-type current meters employ a propeller turning about a horizontal axis. Variable flow conditions may require the use of the pygmy meter, the Price AA meter, or a propeller-type meter, depending on the amount of runoff contributing to streamflow.

5.1.1 Theoretical Considerations

The volume rate of flow of water, which is commonly called discharge (Q), is the product of multiplying the average velocity (V) times the total cross-sectional area (A):

$$Q = V * A$$

The current meter measures velocity at a point. The velocity-area method of making discharge measurements at a cross-section requires measurement of the mean velocity in multiple portions of the cross-section at each of the selected verticals. These are taken at subsections of the cross-section. A complete discussion of area-velocity methods is found in *Measurement and Computation of Streamflow: Volume 1 - Measurement of Stage and Discharge* (Rantz, 1982)

By dividing the stream width into subsections, total discharge becomes the total of discharges measured in each subsection. Velocity (v) is estimated using the two-point method, or for shallow streams, the six-tenths-depth method, measured at each subsection. The two-point method consists of measuring the velocity at 0.2 and then at 0.8 of the depth from the water surface, and using the average of the two measurements. For streams shallower than 2 feet, the six-tenths-depth method will be used. The six-tenths-method consists of measuring the velocity at 0.6 of the depth from the water surface.

Discharge becomes the sum of the products of each point velocity and cross-sectional area of each subsection:

$$Q = \Sigma (v * a)$$

where:

Q = total discharge (in cubic feet per second),
v = point velocity (feet per second), and,
a = area of the subsection (square feet).

In measuring discharges for developing stream ratings for litigation and flood-plain insurance purposes, federal agencies typically base the number of subsections on the criterion that each subsection contain no more than 5 percent of the total discharge. While this method has reportedly resulted in measurement accuracy as high as 98 percent, factors such as the characteristics of the measurement section reduce this accuracy. Furthermore, measurements limiting flow to 5 percent of the total discharge are time-consuming. Therefore, in the interests of conserving time while maximizing measurement accuracy, current-meter measurements performed in channelized streams will be based on selecting subsections to contain approximately 10 percent or slightly more of the total discharge. However, the stream should not be partitioned into sections that are significantly greater than 10 percent of the total stream flow because individual measurements that may be in error will then have a significant impact on the overall average velocity determination.

In general, depending on average depth and velocity distribution, a stream less than 2 feet wide will require no more than 8 to 10 subsections. A stream up to 4 feet wide will require about 10 to 12 subsections. Streams wider than 4 feet will require more subsections. Further, subsections need not be of identical width. For example, because velocities near banks are generally lower than velocities near the center of streams, these subsections may be wider than subsections near the center. Subsections will also be more closely spaced if a stream has an unusually deep portion in the cross-section, or if velocities are higher than usual for the cross-section.

Velocity will be observed by current meter at each point for a period that ranges from 40 to 70 seconds.
The stage of a stream is the height of the water surface above an established datum plane. The water-surface elevation referred to is an arbitrary gage datum called the "gage height." Stage or gage height is to be measured and recorded in feet and tenths of a foot.

5.1.2 Required Measurement Conditions

In order to make a velocity-area discharge measurement using a flowmeter, the following conditions are required:

- The stream must be channelized: that is, observable banks must channel the stream flow;
- Depth must be greater than 0.2 foot across most of the cross-section being measured; and
- The stream must have measurable velocity of at least 0.2 feet per second in most of the

cross-section, although the pygmy meter is capable of measuring velocity as low as 0.070 feet per second.

The first two conditions can often be met in streams of very low discharge by conservatively modifying the stream channel to produce a narrower and slightly deeper cross-section in order to meet measurement requirements. These modifications will include removal of aquatic growth or ice, moving large stones which impact velocity upstream or downstream of the cross-section, and narrowing or deepening of the cross-section. By rearranging small amounts of native rock or sand, the technician will produce a measurable cross-section. When such modifications are made, great care will be exercised to avoid unnecessary movement of sediments or the splashing of sediments or water onto field team members. After clearing the cross-section, flow will be allowed to stabilize before the current-meter measurement of velocities begins.

If depths of 0.2 feet or greater cannot be found or made, the velocity will be estimated by recording the time required for a floating object to cover a known length of the stream. The object velocity will be calculated by multiplying the fixed distance with the average stream area and a correction factor of .9 and dividing by the recorded time. At a minimum, three separate trials will be completed and a mean object velocity calculated.

Current meter measurements are best made by wading, if conditions permit. The Price AA, Pygmy, or propeller-type meters are used for wading measurements. Vertical axis current meters do not register velocities accurately when placed close to a vertical wall. A Price meter held close to a right-bank vertical wall will under-register because the slower water velocity near the wall strikes the effective (concave) face of the cups. The converse is true at a left-bank vertical wall. (The terms "left-bank" and "right-bank" designate direction from the center of a stream for an observer facing downstream). The Price meter also tends to under-register when positioned close to the water surface or close to the streambed.

5.1.3 Equipment

Current meters, timers, depth and width measuring devices, and a means of counting meter revolutions are needed for measurement of discharge. The equipment includes:

- Depth-measuring device
- Current meter
- Width-measuring devices, either engineer's tape or tagline
- Stopwatch
- Marker

Depth-Measuring Device. The depth-measuring device may consist of a graduated rod or staff in feet and tenths. If a Price-type meter is used, the depth-measuring device will be the topsetting 2-inch diameter hexagonal wading rod.

Current Meter. A current meter is an instrument used to measure the velocity of flowing water. The principle of operation is based on the proportionality between the velocity of the water and the resulting angular velocity of the meter's rotor. By placing the current meter at a point in a stream and counting the number of revolutions of the rotor during a measured interval of time, the velocity of water at that point is determined.

Engineer's Tape or Tagline. Steel tapes, metallic tapes, or premarked taglines are used for width determinations during discharge measurements made by wading. Direct measurement of width using tapes or taglines can be accurate with proper precautions. Orientation normal to the flow pattern of the river and elimination of most of the sag, through support or tension, are recommended for improved accuracy.

Stopwatch. A stopwatch is used to measure time during which velocity is measured at each point in the cross-section. Velocity at each point is measured for a period greater than or equal to 40 seconds and less than or equal to 70 seconds.

Marker. Each location where the velocity-area method will be consistently applied will be marked with a field stake.

If a Price meter is used, additional equipment includes a headset. A headset attaches to an electronic connection at the upper end of the wading rod.

5.1.4 Maintenance and Calibration Procedures

Prior to use of the current meter and following use of the meter, tests will be conducted to ensure that the unit performs acceptably. For Price-type and propeller-type meters, calibration tests will be conducted prior to and after fieldwork. Calibration tests will be conducted in streams fitted with Parshall flume or equivalent measurement device. Stream velocities derived from flume readings will be compared to the meter readings.

In addition, for Price-type meters, spin tests will be conducted. The spin test will be performed in an enclosed area, such as in the cab of a truck or in the enclosed rear of a truck, to prevent wind interference. The test is to be performed prior to attaching the current meter to the wading rod. While holding the meter steady in an area sheltered from breezes, the technician will spin the rotor and then press the start button on the stopwatch. The technician will observe the meter until the rotor ceases to spin. The duration of the spin for the pygmy meter should be more than 40 seconds and for the Price AA meter should be more than 90 seconds. If the meter fails to meet the time-of-spin criteria, the meter will be cleaned and oiled before use. If the meter continues to spin well beyond these time limits, the record will indicate that the meter spun for 40+ seconds, in the case of the pygmy meter, or for 90+ seconds, in the case of the Price AA meter.

To ensure reliable observations of velocity, it is necessary that the selected current meter be kept in good condition. Before and after each discharge measurement, meter cups, vanes, or propellers, pivot and bearing, and shaft should be examined for damage, wear, or faulty alignment. During measurements, the meter will be observed periodically when it is out of the water to be sure that the rotor or propeller spins freely.

Meters will be cleaned and, if applicable, oiled daily when in use. If measurements are made in sediment-laden water, the meter will be cleaned immediately after each measurement. After cleaning and lubrication, the rotor or propeller will be spun to make sure that it operates freely. If the rotor or propeller stops abruptly, the cause of the trouble will be sought and corrected before using the meter.

In addition to meter maintenance, the entire meter unit will be checked before departure to the field each day as follows:

- For Price-type meters, attach the current meter and digital counter/headset to the wading rod. Test the headset by:

    1. Spinning the current meter to ensure that audible clicks occur.
    2. If audible clicks do not occur, the following steps should correct the problem:

        - Check that electronic connections are tight;
        - Check that the cat's whisker lightly contacts the upper part of the shaft;
        - Spin again and if audible clicks still do not occur, check that the battery in the headset is properly aligned. Replace the battery, if necessary.

- For propeller-type meters, activate the sensor and test by:

    1. Moving the propeller through the air to ensure that electronic readings are displayed.
    2. If no display is visible, the following steps should be completed:

        - Check that the batteries have power. Replace if necessary;
        - Check that sensor and display are connected to the shaft wire.

5.1.5 General Considerations

Based on approximate depths, either the Price-type or propeller-type meter will be used to perform a velocity-area measurement. If depths or velocities under natural conditions are too low for a dependable current meter measurement, the cross-section will be modified, if practical, to provide acceptable conditions. A shovel will be used to remove aquatic vegetation, ice, or rocks that may interfere with meter operation or discharge measurement.

At each measurement point (or station) across the stream cross-section, depth is measured prior to measurement of velocity. Therefore, it is recommended that the measuring rod be set with the current meter suspended out of the water and above the tagline, which is used to measure width and to identify stations across the cross-section. Placement of the rod about 0.5 feet downstream from the tagline prevents contact between the tagline and the current meter when the meter is lowered into measuring position. The measuring rod will be placed in the stream so the base rests on the streambed, and the depth of water will then be read from the graduated main rod. The main rod is graduated into 0.l-foot increments.

The meter operator reads water depth directly from the depth-measuring rod. In high velocity areas, it is recommended that depth be read as the value between the depth on the upstream side of the rod and the depth on the downstream side of the rod. Depth is measured to the nearest 0.02 foot. This depth is used to set the vertical location on the current meter.

The meter operator will stand in a position that least affects the velocity of the water passing the current meter. The meter operator will face upstream while holding the depth-measuring rod vertically and close to the tagline or measuring tape. The meter operator stands at about a 45-degree angle downstream from the measuring rod and at least 1.5 feet from the depth-measuring rod. This angle is an imaginary angle between the extended arm holding the depth-measuring rod and the tagline or measuring tape. The meter operator should avoid standing in the water if his or her feet and legs occupy a significantly large percentage of a narrow cross-section. For narrow streams, it is often possible to stand astride the stream.

The depth-measuring rod should be held in a vertical position with the meter parallel to the direction of flow while the velocity is being observed. When measuring streams that have shifting beds, the soundings or velocities can be affected by the scoured depressions left by the hydrographer's feet. For such streams, the meter should be placed ahead of and upstream from the operator’s feet.

5.1.6 Discharge Calculations

A stream discharge is the summation of the products of the subsection areas of the stream cross-section and their respective average velocities. The formula $Q = \Sigma (v * a)$ represents the computation, where Q is the total discharge, a is an individual subsection's area, and v is the corresponding mean velocity of flow normal to the subsection. The summation of the discharges for all the subsections is the total discharge of the stream. The order for calculating discharge is:

- Use the distances from initial point to compute width for each section. The first width is computed by subtracting the first distance from the second distance, and dividing this quantity by two. The second width will be the quantity of difference between the third distance and the first distance, divided by two. For each subsequent width, subtract the distance on the line above the line you are calculating from the distance on the line below the line you are calculating, and divide this quantity by two. This procedure is carried out for each line until you reach the final width calculation. This is calculated as the quantity of the difference between the final distance and the second-to-the-last distance, divided by two.

- Subsequent calculations will be performed as follows:

    - Calculate each discharge for each subsection by multiplying the width of the subsection times the depth times the velocity.

    - Sum the discharges for each subsection to arrive at total discharge for the entire cross-section.

- Check your math by summing the subsection widths. Their total should equal the value obtained by taking the difference between the left and right bank station distances from initial point.

- Initial at the line "Comp. by" to identify yourself as the person responsible for performing the discharge calculation.

5.2 VOLUMETRIC METHOD

The volumetric method is a simple and accurate method for measuring flow from small discharges such as gravity flow discharges from pipe outlets.

5.2.1 Theoretical Considerations

This method involves measuring the time required to fill a container of known capacity, or the time required to partly fill a calibrated container to a known volume. Alternatively, in the case of measuring discharge remotely in a sump or standpipe setting, the volumetric method may be performed by capturing flow in a container for a set period of time. This volume of water is then measured and discharge is determined.

5.2.2 Required Measurement Conditions

Conditions must be such that all discharge from an outlet can be captured in the volumetric container during the period of measurement.

5.2.3 Equipment

The bucket and stopwatch technique is particularly useful for the measurement of small flows. Equipment required to make this measurement is a calibrated container and a stopwatch. Calibrated containers of varying sizes will include:

- 5-gallon bucket
- 2-liter graduated cylinder
- 1-liter graduated cylinder
- 1-liter bucket
- 500-milliliter beaker
- 250-milliliter beaker

5.2.4 Maintenance and Calibration Procedures

Graduated cylinders are incremented in terms of milliliters and can be easily converted to gallons. The incremental volume of a 5-gallon bucket can be determined by adding known volumes of water and recording the depth after each addition.

5.2.5 General Considerations

Upon arrival at the site, the sampling personnel will evaluate the flow conditions to select the appropriate method for flow measurement. If flow conditions are appropriate for volumetric measurement, the sampling personnel will observe and use judgment in approximating the flow volume and will select an appropriately sized volumetric container.

Sampling personnel will use a stopwatch to measure the time required to fill a volumetric container. The sampler will time flow into the container for a minimum of 10 seconds. Three consecutive measurements will be made and noted, and the results will be averaged to determine the discharge.

5.2.6 Discharge Calculations

Discharge will be determined initially in gallons per second (gal/s) or in milliliters per second (ml/s). These values will be noted, but the average value will be reported in cubic feet per second. Calculations will be performed as follows:

- Record each of the three measurements in terms of gallons per second or milliliters per second, depending on the volumetric container.

- If one of the three measurements is 50 percent or more different from the other two measurements, then this value will not be used. Instead, three additional measurements will be taken and, provided that none of these three measurements differs by greater than 50 percent from the other two measurements, these values will be used.

- Average the three values.

- Convert the averaged value to cfs as follows:

    - To convert ml/s to cfs, multiply by 3.5. x 10^{-5}

    - To convert gal/s to cfs, multiply by 0.134

- Record discharge in cfs.

6.0 REFERENCES

Linsley R.K, Kohler, M.A., Paulhus, J.L.H. 1982. *Hydrology for Engineers*. McGraw-Hill Book Company. New York, N.Y.

Rantz, S.E., et al. 1982. *Measurement and Computation of Streamflow: Volume 1; Measurement of Stage and Discharge*. Geological Survey Water-Supply Paper 2175. U.S. Government Printing Office. Washington, D.C.

Rantz, S.E., et al. 1982. *Measurement and Computation of Streamflow: Volume 2: Computation of Discharge*. Geological Survey Water-Supply Paper 2175. U.S. Governmental Printing Office. Washington, D.C.

Robertson, J.A., Cassidy, J.J., and Chaudhry, M.H. 1988. *Hydraulic Engineering*. Houghton Mifflin Company. Boston, MA

MWH
MONTGOMERY WATSON HARZA

SOP-5

GROUNDWATER LEVEL DATA COLLECTION

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 PURPOSE

The purpose of this technical procedure is to establish a uniform and consistent procedure for measuring water levels in wells, piezometers and boreholes.

The groundwater level measurement procedures presented in the following sections were developed using standard industry-accepted practices, as well as international organization and agency guidelines and standard practices. The same care must be exercised in implementing field investigations and sampling events that are exercised in planning the program design and analyzing samples in the laboratory. No analytical result is better than the sample from which it was obtained.

Specific organizations and agencies with guidelines and standard procedures that were used include:

- U.S. Environmental Protection Agency (EPA)
- State of Nevada (U.S.) Division of Environmental Protection (NDEP)
- American Society of Testing and Materials (ASTM)

2.0 DEFINITIONS

2.1 Electric Water Level Sounder (EWS)

An electronic water-level sounder (EWS) is an instrument for measuring water levels in wells, piezometers and boreholes. An EWS is essentially an open circuit involving an ammeter and battery mounted on a reel to which an insulated two-wire electric cord (calibrated by length) is wound. The circuit is closed, and a buzzer sounds when the electrodes on the probe are immersed in water. Depth to water is recorded at the depth where the buzzer sounds.

3.0 DISCUSSION

Measurement of static water levels may constitute a separate task or be performed in conjunction with groundwater sampling. Prior to any purge sampling activity at each monitor well, a water level measurement is required to be taken. Measurement of the static water level is important in determining the hydrogeologic characteristics of the groundwater system.

Prior to taking the EWS to the field, check that the EWS is functioning properly and that the batteries are in working order by turning instrument on and pushing the test button located on the side of the instrument. Also verify that the probe is functioning properly by submerging it in tap water. Both the audio and visual signals should function.

Decontaminate the probe and cord of the EWS using Alconox or equivalent non-phosphate detergent and distilled water. Rinse a minimum of three (3) times with distilled water. At a minimum decontaminate the probe and the length of reel you believe will be in the well plus an additional 3 meters.

The measurement will be referenced from the reference point marked on the top of the well casing; this is typically located on the north side of the casing. The measurement to the static water level in the well will be to the nearest 0.01-foot interval. The measurement will be immediately repeated to verify the accuracy of the initial reading. The depth to water measurement will be compared in the field to previous measurements to verify that the measurement is reasonable. Record the depth to water level on the field logbook and Record of Water Level Readings form (see Appendix A). Other items to record include well identification number, casing diameter, vertical height of measuring point above ground surface, and time and date of measurement.

If depth to water is measured in an open borehole, note that the reference level is ground surface. Also note, especially if the ground is uneven, from which side of the borehole (i.e. north, etc.) the measurement was referenced.

In addition, it is good practice to periodically measure total well depth, since silt can build up and decrease the total depth of the well. Measure the total depth of the well following determination of static water level. If using the EWS to determine the depth of the well, make sure that the additional cable that will be submerged has been decontaminated and that the probe tip length is added to the total depth measured. Total well depth measurement also ensures that the well is in good condition to total depth.

4.0 EQUIPMENT AND MATERIAL

The following is a list of equipment that should be available in the field to perform water level measurements.

- Electric Water-level Sounder or Measuring Tape with a Wetable Surface
- Folding Rule
- Field logbook or field data sheet (see Record of Water Level Readings form, found in Appendix A)
- Data on Well Identification Number and Locations
- Spare Battery for Electric Water-level Meter
- Permanent, waterproof pens

5.0 PROCEDURES

- Record well identification number and measuring device type and serial number.
- Each water level sounder or measuring tape used for recording water levels should have the depth graduations checked with an independent folding rule or measuring tape for calibration prior to field use.
- Clean all downhole instruments and equipment before and after measurements between wells. Cleaning should be with a non-phosphate detergent rinse followed by a rinse with approved tap water, then rinse with organic free distilled or deionized water.

- Measure and record distance from ground level to top of casing or standpipe. Measure the vertical distance from the top of casing or standpipe to the point of the elevation survey mark (if different from top of casing or standpipe).

- If an EWS is used, turn on the EWS, check the battery, lower the wire into the borehole or standpipe and stop at the depth where the EWS meter indicates a repeatable, completed circuit. Record the length of the wire below the casing collar or top of the standpipe to the nearest 0.01-foot.

- If a measuring tape is used, lower the tape (with a weight attached) into the borehole. The tape must be lowered a sufficient depth into the well to ensure the wetable surface section of the tape is partially submerged. The total length of the tape within the well (from the top of casing or standpipe) and the length of the wetted surface to the submerged end of the tape will be recorded.

- Record date, time, well designation, measuring device and all measurements on a Record of Water Level Readings form (Appendix A), and bound logbook. The personnel making the measurement will initial or sign each measurement recorded. All water level measurement records will be maintained in the project records files.

6.0 REFERENCES

American Society of Testing and Materials (ASTM). 1994. *Standards on Ground Water and Vadose Zone Investigations*. Second Edition. ASTM Committee D-18 on Soil and Rock. Philadelphia, Pa.

American Society of Testing and Materials (ASTM), 1995. *ASTM Standards on Environmental Sampling*. PCN-03-418095-38, Philadelphia, Pa.

U.S. Environmental Protection Agency (EPA), 1994. *Standard Operating Procedures for Field Sampling Activities, Version 2*. EPA Region VIII, Denver, Colorado.

U.S. Environmental Protection Agency (EPA), 1995. *Standard Operating Procedures for Water Level and Non-Aqueous Phase Liquid (NAPL) Measurements in Boreholes and Monitoring Wells, Version 1*. EPA Region VIII, Denver, Colorado.

APPENDIX A

RECORD OF WATER LEVEL READINGS

RECORD OF WATER LEVEL READINGS

Job No. ____________________ **Project No.** _________________________ **Location** ___________________

Borehole No.	Date	Time	Measuring Device	Reading	Corrections Or Conversions	Water Level	Surf. Elev.	Water Level Elev.	By	Comments

STANDARD OPERATING PROCEDURE

LOW STRESS PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

(Based on EPA Region 1, Revision 2. July 30, 1996.)

1.0 INTRODUCTION

This standard operating procedure (SOP) is intended to serve as a reference for the proper equipment and techniques for collecting groundwater samples by low-stress sampling techniques. The purpose of this SOP is to enable the user to collect representative and defensible groundwater samples, and to plan the field sampling effort. The techniques presented will be followed whenever applicable, although site-specific conditions or project-specific requirements may warrant adjustments in methodology. This SOP is based on EPA Region 1, Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, Revision 2, July 30, 1996, which is attached as Attachment A.

This SOP describes groundwater sample collection by low-stress sampling methods, only. All other groundwater sampling procedures will be performed in accordance with the Field Sampling Plan of the

MONITORING WELL LOW-STRESS SAMPLING

Monitoring wells can be sampled with bladder pumps using lower flow rates. Studies have shown that groundwater in the screened interval of a standard monitoring well can be representative of groundwater in the formation, even though stagnant water lies above in the casing. This occurs when flow is generally horizontal and naturally purges the screened interval. However, the insertion of a sampling device, such as a bailer or pump, can disrupt this equilibrium and cause mixing of the screened and cased interval waters. The mixture of stagnant and screened interval water can even be forced into the aquifer, resulting in chemical and microbiological effects that may affect data quality. Therefore, low-stress sampling techniques are most accurate using dedicated sampling devices that can be left in place within a monitoring well. Considerations also need to be made for switching between standard purge volume and low-stress sampling methods.

The objective of low-stress sampling is to minimize the velocity/stress on the sample water as it exits the formation into the screened interval of the well and as it enters the pump. Flow rates from 0.1 to 0.5 liter/minute (l/min) are typical for this sampling procedure. When performed correctly, water sampled using the low-stress technique is produced from the screened interval without disturbing stagnant water in the well casing. By using low flow rates to stabilize drawdown at less than the goal of 0.30 feet, only screened interval water will be sampled. Depth to water measurements during purging are recorded to verify that less than 0.3 feet of drawdown has occurred. In those cases where drawdown is observed to be greater than 0.3 feet, the pumping rate will be reduced by decreasing the pumping rate. If the pumping rate is reduced to less than 0.25 liters per minute and the drawdown still exceeds 0.3 feet after two 2-minute intervals, pumping will be halted. Project-specific work plans should be developed in cases where low-stress sampling with less than 0.30 feet of drawdown can not be achieved. Under these cases, the Project Manager must approve of alternative sampling methods prior to sampling. If drawdown is ever observed to be greater than 0.5 feet, pumping will be halted and the will be allowed to recover before resuming low-stress sampling or purging at a lower pumping rate.

The following procedures will be used while performing low-stress purging and sampling:

1. Install a bladder pump in the well (if one does not already exist). Slowly lower the bladder pump into the well to minimize disturbance of the stagnant water within the well. Place the pump inlet in the screened interval at the appropriate depth, which should be near the midpoint of the screened interval unless site-specific conditions dictate placing the pump at a different point within the screened interval. Wait at least 48 hours after pump installation before purging and sampling.

2. Before initiating purging, place an electric water level indicator down to the top of the static water table and record the depth to groundwater.

3. Begin purging groundwater at a rate between 100 to 500 ml/min, making sure to minimize drawdown to less than 0.3 feet as a goal. Rates up to approximately 1 l/min may be feasible in high hydraulic conductivity formations, only if the

drawdown continues to be less than 0.3 feet. Measure drawdown at intervals of five minutes or less during purging. Adjust the purge rate to balance the desired (low) purge rate and water level drawdown. If the recharge to the well is less than 100 ml/min (i.e., excessive drawdown is occurring), proceed to Step 6.

4. The minimum volume to be purged from the well is two times the volume of the tubing and pump (available from the manufacturer). The tubing volume will be determined by multiplying the volume per foot of tubing (available from the manufacturer) by the total length of tubing.

5. During purging, measure the following groundwater quality parameters: pH, temperature, electrical conductivity, turbidity, DO, and ORP. The parameters will be considered stable when three consecutive readings, collected at intervals of at least five minutes, are within:

Conductivity	±10%
pH	±0.2 units
Temperature	±1 degree Celsius
Dissolved Oxygen	±0.2 mg/l
ORP	±10 millivolts
Turbidity	<5 NTU.

However, if the turbidity is not ≤5 NTU, but is stable (within ± 10 percent between readings) within a four-hour period, and all other parameters are stable, the samples will be collected. Once the parameters have stabilized, collect the samples.

6. If the well produces water at an extremely slow rate and excessive drawdown is occurring (> 0.30 feet.), even at a pumping rate of 100 ml/min, low-stress procedures may not be the best sampling method for the well. It is recommended that the standard practice for sampling low-recharge rate wells using bladder pumps be followed.

ATTACHMENT A

LOW STRESS PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

(Based on EPA Region 1, Revision 2. July 30, 1996.)

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

July 30, 1996
Revision 2

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

I. SCOPE & APPLICATION

This standard operating procedure (SOP) provides a general framework for collecting ground water samples that are indicative of mobile organic and inorganic loads at ambient flow conditions (both the dissolved fraction and the fraction associated with mobile particulates). The SOP emphasizes the need to minimize stress by low water-level drawdowns, and low pumping rates (usually less than 1 liter/min) in order to collect samples with minimal alterations to water chemistry. This SOP is aimed primarily at sampling monitoring wells that can accept a submersible pump and have a screen, or open interval length of 10 feet or less (this is the most common situation). However, this procedure is flexible and can be used in a variety of well construction and ground-water yield situations. Samples thus obtained are suitable for analyses of ground water contaminants (volatile and semi-volatile organic analytes, pesticides, PCBs, metals and other inorganics), or other naturally occurring analytes.

This procedure does not address the collection of samples from wells containing light or dense non-aqueous phase liquids (LNAPLs and DNAPLs). For this the reader may wish to check: Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation; C.K. Smoley (CRC Press), Boca Raton, Florida and U.S. Environmental Protection Agency, 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance; Washington, DC (EPA/530-R-93-001).

The screen, or open interval of the monitoring well should be optimally located (both laterally and vertically) to intercept existing contaminant plume(s) or along flowpaths of potential contaminant releases. It is presumed that the analytes of interest move (or potentially move) primarily through the more permeable zones within the screen, or open interval.

Use of trademark names does not imply endorsement by U.S.EPA but is intended only to assist in identification of a specific type of device.

Proper well construction and development cannot be overemphasized, since the use of installation techniques that are appropriate to the hydrogeologic setting often prevents "problem well" situations from occurring. It is also recommended that as part of development or redevelopment the well should be tested to determine the appropriate pumping rate to obtain stabilization of field indicator parameters with minimal drawdown in shortest amount of time. With this information field crews can then conduct purging and sampling in a more expeditious manner.

The mid-point of the saturated screen length (which should not exceed 10 feet) is used by convention as the location of the pump intake. However, significant chemical or permeability contrast(s) within the screen may require additional field work to determine the optimum vertical location(s) for the intake, and appropriate pumping rate(s) for purging and sampling more localized target zone(s). Primary flow zones (high(er) permealability and/or high(er) chemical concentrations) should be identified in wells with screen lengths longer than 10 feet, or in wells with open boreholes in bedrock. Targeting these zones for water sampling will help insure that the low stress procedure will not underestimate contaminant concentrations. The Sampling and Analysis Plan must provide clear instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met. If after 4 hours of purging indicator field parameters have not stabilized, one of 3 optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization) c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may not meet the sampling objectives).

Changes to this SOP should be proposed and discussed when the site Sampling and Analysis Plan is submitted for approval. Subsequent requests for modifications of an approved plan must include adequate technical justification for proposed changes. All changes and modifications must be approved before implementation in field.

II. EQUIPMENT

A. Extraction device

Adjustable rate, submersible pumps are preferred (for example, centrifugal or bladder pump constructed of stainless steel or

Teflon).

Adjustable rate, peristaltic pumps (suction) may be used with caution. Note that EPA guidance states: "Suction pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" (EPA/540/P-87/001, 1987, page 8.5-11).

The use of inertial pumps is discouraged. These devices frequently cause greater disturbance during purging and sampling and are less easily controlled than the pumps listed above. This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

B. Tubing

Teflon or Teflon lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for inorganics analyses. However, these materials should be used with caution when sampling for organics. If these materials are used, the equipment blank (which includes the tubing) data must show that these materials do not add contaminants to the sample.

Stainless steel tubing may be used when sampling for VOCs, SVOCs, pesticides, and PCBs. However, it should be used with caution when sampling for metals.

The use of 1/4 inch or 3/8 inch (inner diameter) tubing is preferred. This will help ensure the tubing remains liquid filled when operating at very low pumping rates.

Pharmaceutical grade (Pharmed) tubing should be used for the section around the rotor head of a peristaltic pump, to minimize gaseous diffusion.

C. Water level measuring device(s), capable of measuring to 0.01 foot accuracy (electronic “tape”, pressure transducer). Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level “tape” at the start and end of each record.

D. Flow measurement supplies (e.g., graduated cylinder and stop watch).

E. Interface probe, if needed.

F. Power source (generator, nitrogen tank, etc.). If a gasoline generator is used, it must be located downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate the samples.

G. Indicator field parameter monitoring instruments - pH, Eh, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Use of a flow-through-cell is required when measuring all listed parameters, except turbidity. Standards to perform field calibration of instruments. Analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846. For Eh measurements, follow manufacturer's instructions.

H. Decontamination supplies (for example, non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.).

I. Logbook(s), and other forms (for example, well purging forms).

J. Sample Bottles.

K. Sample preservation supplies (as required by the analytical methods).

L. Sample tags or labels.

M. Well construction data, location map, field data from last sampling event.

N. Well keys.

O. Site specific Sample and Analysis Plan/Quality Assurance Project Plan.

P. PID or FID instrument (if appropriate) to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

III. PRELIMINARY SITE ACTIVITIES

Check well for security damage or evidence of tampering, record pertinent observations.

Lay out sheet of clean polyethylene for monitoring and sampling equipment.

Remove well cap and immediately measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook.

A synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin. It is recommended that water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) be measured the day before, in order to allow for re-settlement of any particulates in the water column. If measurement of total well depth is not made the day before, it should not be measured until after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe are usually not needed unless analytical data or field head space information signal a worsening situation. Note: procedures for collection of LNAPL and DNAPL samples are not addressed in this SOP.

IV. PURGING AND SAMPLING PROCEDURE

Sampling wells in order of increasing chemical concentrations (known or anticipated) is preferred.

1. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the midpoint of the zone to be sampled. The Sampling and Analysis Plan should specify the sampling depth, or provide criteria for selection of intake depth for each well (see Section I). If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well. Collection of turbid free water samples may be especially difficult if there is two feet or less of standing water in the well.

2. Measure Water Level

Before starting pump, measure water level. If recording pressure transducer is used-initialize starting condition.

3. Purge Well

3a. Initial Low Stress Sampling Event

Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.

Monitor and record water level and pumping rate every three to five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (for example, 0.1 - 0.4 l/min) to ensure stabilization of indicator parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen). The final purge volume must be greater than the stabilized drawdown volume plus the extraction tubing volume.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment. If the recharge rate of the well is lower than extraction rate capabilities of currently manufactured pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized.

3b. Subsequent Low Stress Sampling Events

After synoptic water level measurement round, check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). Perform purging operations as above.

4. Monitor Indicator Field Parameters

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, Eh, DO) every three to five minutes (or less frequently, if appropriate). Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at three (3) to five (5) minute intervals, are within the following limits:

turbidity (10% for values greater than 1 NTU),
DO (10%),
specific conductance (3%),
temperature (3%),
pH (± 0.1 unit),
ORP/Eh (± 10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell and may also cause an underestimation of turbidity values measured after the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities.

The flow-through-cell must be designed in a way that prevents air bubble entrapment in the cell. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must be submerged in water at all times. If two flow-through-cells are used in series, the one containing the dissolved oxygen probe should come first (this parameter is most susceptible to error if air leaks into the system).

5. Collect Water Samples

Water samples for laboratory analyses must be collected before water has passed through the flow-through-cell (use a by-pass assembly or disconnect cell to obtain sample).

VOC samples should be collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

During purging and sampling, the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use one of the following procedures to collect samples: (1) add clamp, connector (Teflon or stainless steel) or valve to constrict sampling end of tubing; (2) insert small diameter Teflon tubing into water filled portion of pump tubing allowing the end to protrude beyond the end of the pump tubing, collect sample from small diameter tubing; (3) collect non-VOC samples first, then increase flow rate slightly until the water completely fills the tubing, collect sample and record new drawdown, flow rate and new indicator field parameter values.

Add preservative, as required by analytical methods, to samples immediately after they are collected if the sample containers are not pre-preserved. Check analytical methods (e.g. EPA SW-846, water supply, etc.) for additional information on preservation. Check pH for all samples requiring pH adjustment to assure proper pH value. For VOC samples, this will require that a test sample be collected during purging to determine the amount of preservative that needs to be added to the sample containers prior to sampling.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter is required, and the filter size (0.45 um is commonly used) should be based on the sampling objective. Pre-rinse the filter with approximately 25 - 50 ml of ground water prior to sample collection. Preserve filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in ground water for human health risk calculations.

Label each sample as collected. Samples requiring cooling (volatile organics, cyanide, etc.) will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

6. Post Sampling Activities

If recording pressure transducer is used, remeasure water level with tape.

After collection of the samples, the pump tubing may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth is optional after the initial low stress sampling event. However, it is recommended if the well has a “silting” problem or if confirmation of well identity is needed.

Secure the well.

V. DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed between purging and sampling operations. The pump and tubing (including support cable and electrical wires which are in contact with the well) will be decontaminated by one of the procedures listed below.

Procedure 1

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then this step may be skipped.

Flush with distilled/deionized water. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

VI.FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed 20 samples). Trip blanks are required for the VOC samples at a frequency of one set per VOC sample cooler.

Field duplicate.

Matrix spike.

Matrix spike duplicate.

Equipment blank.

Trip blank (VOCs).

Temperature blank (one per sample cooler).

Equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank will only include the pump in subsequent sampling rounds.

Collect samples in order from wells with lowest contaminant concentration to highest concentration. Collect equipment blanks after sampling from contaminated wells and not after background wells.

Field duplicates are collected to determine precision of sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

If split samples are to be collected, collect split for each analyte group in consecutive order (VOC original, VOC split, etc.). Split sample should be as identical as possible to original sample.

All monitoring instrumentation shall be operated in accordance with EPA analytical methods and manufacturer's operating instructions. EPA analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846 with exception of Eh, for which the manufacturer's instructions are to be followed. Instruments shall be calibrated at the beginning of each day. If a measurement falls outside the calibration range, the instrument should be re-calibrated so that all measurements fall within the calibration range. At the end of each day, check calibration to verify that instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, need not be calibrated to the above frequency. They should be checked for accuracy prior to field use according to EPA Methods and the manufacturer's instructions.

VII. FIELD LOGBOOK

A field log shall be kept to document all ground water field monitoring activities (see attached example matrix), and record all of the following:

Well identification.

Well depth, and measurement technique.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.

Well sampling sequence and time of each sample collection.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analysis.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling equipment used, including trade names, model number, diameters, material composition, etc.

VIII. DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, and whatever field logbook information is needed to allow for a full evaluation of data useability.

MWH
MONTGOMERY WATSON HARZA

SOP-NW-5.3

Collection of Groundwater Quality Samples

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

This technical procedure establishes methods for collecting groundwater samples for chemical analysis representative of aquifer water quality.

This technical procedure is designed to cover general techniques for obtaining valid, representative samples from groundwater monitoring wells. The scope is intended to provide guidance while preparing for and during actual field sampling activities. The specific methods to be used at each monitoring well are described in the applicable workplan or sampling analysis plan (SAP).

This technical procedure is applicable to all MWH personnel engaged in the collection of groundwater samples from wells for purposes of chemical analysis and are intended to be used in conjunction with a project-specific workplan or SAP.

2.0 DEFINITIONS

2.1 Dedicated Pump System

A dedicated pump system is a permanently installed device for removing water from a well. The system is not removed from the well and does not have the potential to become contaminated between uses.

2.2 Well Storage Volume

Well storage volume is defined as the volume of water enclosed by the well casing and screen gravel/sand pack under equilibrium conditions.

2.3 Bailer

A bailer is a tubular device, with a check-valve at the top and/or bottom, used for collecting and removing groundwater from wells. The three most common types of bailers are: Single check valve; double check valve; and "thief" or "messenger" samplers.

- A single check valve bailer will expose part of the sample to the atmosphere. The typical sample transfer occurs by inserting a tube into the bottom of the bailer, pushing up the check valve, which allows the water to be released into the sample container. If used for VOC sampling the bailer should have a sample cock or draft valve at or near the bottom of the sampler allowing withdrawal of the sample from the well below the exposed surface water. Otherwise, discard the first few inches of sample at the bottom of the bailer.

- The double check valve sampler allows for point source sampling at a specific depth. The liquid will pass through the sampler while it is descending until the desired depth is reached. Once retrieval of the sample commences, both check valves close simultaneously, thereby allowing the specific depth to be sampled.

- The thief or messenger sampler also allows for point source sampling at a specific depth. A weighted messenger is dropped down the suspension line and closes the sampling vessel thus obtaining a sample at the desired depth.

To avoid potential sources of contamination, keep the bailer suspension lines off the ground and away from any other potentially contaminating sources to minimize the possibility of contaminants being carried down into the well. If needed, a decontaminated tarp or plastic bag is recommended for storage of the bailer suspension line.

2.4 Non-Dedicated Sampling Apparatus

A non-dedicated sampling apparatus is sampling equipment that is not used solely for collection of groundwater samples from a single well. This term is also used to describe equipment that is only used for sampling a single well, but is removed from the well and could potentially become contaminated.

2.5 Groundwater Sample

A groundwater sample is defined as water acquired from a well for chemical analyses that is representative of groundwater within the aquifer or the portion of the aquifer being sampled.

2.6 Positive Pressure Pump

A positive pressure pump is a device for removing water from a well by forcing water to the surface through positive pressure when operated below the water level in a well. A positive pressure pump may be operated electrically, mechanically, or by air/nitrogen pressure. Submersible impeller, bladder, and check valve pumps are common types of positive pressure pumps.

2.7 Suction Lift Pump

A suction lift pump is a device for removing water from well by negative pressure (suction). Direct line, peristaltic and centrifugal pumps are the three types of suction lift pumps. The limitation for lifting water by suction is usually 20 to 25 feet. These pumps are only acceptable for non-volatile analytes and analytes that are not affected by aeration or changes in pH. They are useful as purging devices for shallow groundwater wells.

Peristaltic pumps are preferred when a suction lift pump is required. This is the only suction lift pump, of the three mentioned above, in which the liquid being sampled moves entirely within the sample tubing. The groundwater sample never contacts the actual pump apparatus during sampling thus eliminating a possible source of sample contamination from the actual pump, lubricants, or parts.

Standard silicon tubing is the most commonly used sample tubing. Most pump manufacturers and rental companies offer acceptable tubing lined with TFE-fluorocarbons or Viton. The National Council of the Paper Industry for Air and Stream Improvement recommends medical grade silicon tubing for organic sampling;

however, it is limited to use over a restricted range of ambient temperatures. Standard silicon tubing uses an organic vulcanizing agent, which has been shown to leach into samples.

2.8 Sample Bottles

Sample bottles are containers specifically designed and prepared for storing liquid samples. Sample bottle type, material, size, and type of lid shall be as specified in the governing workplan or SAP. Sample bottles must be properly cleaned and prepared by a laboratory or the manufacturer in accordance with standard laboratory methods and procedures. Coordinate with selected analytical laboratory for bottle type and preparation requirements.

2.9 Acceptable Material

Acceptable materials are defined as pump systems that have minimal effect on water quality when used to obtain groundwater samples from wells. The use of pumps is dependent on the analyses being conducted on the acquired samples. The parts of pumps that will contact the groundwater sample contain only acceptable materials.

3.0 RESPONSIBILITIES

3.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure.

3.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

3.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Task Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, groundwater purging and sampling forms, generated data, and other associated and pertinent project information.

4.0 DISCUSSION

The following is a listing of general procedures that should be followed during every sampling event.

- Groundwater samples shall be collected in quantities and types as described in the governing workplan or SAP.
- Water level data collection (see MWH SOP-5 for appropriate procedure).
- Determination of well storage volume (see Section 5.2.1, below).
- All instruments used for field analyses should be calibrated in accordance with the manufacturer's instructions.
- All non-dedicated sampling equipment shall be decontaminated before and after each use.
- If so directed by the governing workplan or SAP, purge water and decontamination fluids shall be captured and contained for disposal.
- Samples shall be collected in properly prepared containers of the appropriate size and type, and all samples shall be appropriately labeled and sealed, as required by the governing workplan or SAP.
- Samples shall be stored and transported in coolers chilled to 4º Celsius or less. Sample handling and chain of custody shall be as specified in the governing workplan or SAP.
- The Groundwater Purging and Sampling Form (see Appendix A) and the field log book shall be used to document daily site activities and sample collection.
- All variations from established procedure shall be documented on the Groundwater Purging and Sampling Form (see Appendix A) and shall be approved by the Project Manager prior to proceeding with the work variation.

PROCEDURE

5.1 General Considerations

5.1.1 Decontamination

All non-dedicated sampling equipment that may contact the sample must be decontaminated before and after each use unless it is disposable and being used for only a single well. Non-dedicated pumps or bailers require decontamination of internal and external parts prior to being lowered into the well. Non-dedicated equipment shall first be washed with clean tap water (whose chemistry is known and acceptable), non-phosphate detergent, and rinsed with clean tap water. For inorganic analytes a weak hydrochloric acid (HCl) or nitric acid (HNO_3) solution shall be used for the second wash. For organic analytes, reagent-grade methanol shall be used for the second wash. A final rinse with organic-free distilled/deionized water shall complete the decontamination. At a minimum, all acid and methanol wash solutions must be captured (see Section 5.5.1, below).

5.1.2 Sample Quantities, Types, and Documentation

Samples shall be collected in quantities and types as specified in the governing workplan or SAP.

The Groundwater Purging and Sampling Form (Appendix A) and the field logbook shall be used to document daily site activities and sample collection (see Section 5.6, below). Samples shall be transferred to the analytical laboratory under formal chain of custody, which shall be documented and maintained in accordance with procedure.

5.1.3 Sample Containers

All sample bottles must be properly cleaned and prepared. Coordinate with selected analytical laboratory for appropriate sample bottle types and preparation requirements. All groundwater samples shall be labeled and sealed and immediately placed in coolers chilled to 4º Celsius or less with securely closed lids and custody seals on the outside of the cooler for storage and transport. Samples must be received by the analytical laboratory in sufficient time to conduct the requested analyses within the specified holding time.

5.1.4 Acceptable Materials

Stainless steel and fluorocarbon resin (Teflon, PTFE, FEP, or PFA) are acceptable materials that may contact groundwater samples. Glass is an acceptable material for contacting samples except when silica or fluoride analyses are to be performed. Plastics (PVC, polyethylene, polypropylene, tygon) are an acceptable material for contacting samples when the analyses are for inorganic analytes (metals, radionuclides, anions, cations).

5.1.5 Sample Acquisition

Groundwater samples shall be removed from the well with the use of a permissible pump or bailer. Electric positive-pressure pumps, as defined in Section 3.6, made of acceptable materials are permissible to use for acquiring any groundwater sample. Air/nitrogen pressure activated positive-pressure pumps made of acceptable materials are permissible to use for acquiring any groundwater sample if the air/nitrogen does not contact the sample. Positive-pressure pumps operated by mechanically forcing water through check valves are permissible for acquiring groundwater samples. Bailers made of acceptable materials are permissible for acquiring groundwater samples.

Peristaltic pumps and airlift pumps are not preferred for acquiring groundwater samples but are permissible when samples are to be analyzed for analytes that are not volatile, are not affected by aeration, and are not affected by changes in pH.

Other types of pumps (peristaltic, centrifugal, air lift, recirculation, etc.) may be used for purging groundwater from wells prior to sample acquisition, if: (1) pump materials contacting well water are acceptable; (2) pumping does not aerate or change the pH of the remaining well water; and (3) pumped water does not mix with remaining well water during pumping or after the pumping is stopped.

5.2 Equipment And Materials

If wells are equipped with dedicated pump systems, equipment to operate the dedicated pump systems (i.e., air compressor, compressed air or nitrogen cylinders, electric generator, etc.) as well as non-dedicated sampling apparatus, such as surface discharge tubing and valves, may be necessary.

If wells do not have permissible and dedicated pump systems, permissible pump systems or bailers and accessories of small enough diameter to enter the wells will be necessary. All equipment that could contact the sample shall be made of acceptable materials.

Sample bottles and preservatives appropriate for the parameters to be samples will be necessary. Coordinate with selected analytical laboratory for bottle type and preparation requirements.

Field test equipment necessary for groundwater sampling:

- Thermometer
- pH meter and standards
- Conductivity meter and standards
- dissolved oxygen meter (optional)
- turbidity meter and standards
- Filtration apparatus (0.45 micron), if necessary
- Depth to water measuring device
- Coolers and ice packs
- Organic-Free Distilled or deionized water
- Cleaning equipment (scrub brushes) and solutions (non-phosphate detergent)
- Indelible ink pens and felt-tip markers
- Sample labels and seals
- Container(s) for capturing, containing, treating and measuring waste decontamination solutions, if necessary.
- Well specifications
- Groundwater Purging and Sampling Forms (Appendix A)
- Field logbook
- Chain of Custody Forms (provided by selected laboratory)
- As required, 55 gallon steel drums fitted with bung holes, or suitable tank(s) for containing purged

groundwater.
- Additional preservatives (i.e., HNO_3)
- Copy of this SOP, SOP-5 and the governing workplan or SAP.

5.3 Groundwater Sample Acquisition

5.3.1 Purging the Well

The pump or bailer shall be used and operated in accordance with the manufacturer's operational manual. Before collecting the actual groundwater sample, a minimum of three (3) well bore storage volumes of water shall be purged from the well by pumping unless low-flow sampling techniques are being employed. Calculate this volume by measuring the depth to water and subtracting this depth from the total depth of the well. If a gravel/sand pack surrounds the screen, the pore volume of the gravel/sand pack (assume a porosity of 25 percent if unknown) shall be added to the total well volume. While purging water from the well, the conductivity, pH, temperature, dissolved oxygen (optional) and turbidity of the water shall be periodically measured. If the conductivity (within 10%), pH (within 0.1 pH units), temperature (within 0.5 degrees Celsius), dissolved oxygen (within 10%) or turbidity (within 10% and less than 5 NTU) of the water has not stabilized when a minimum of three (3) well volumes have been purged, then continue to purge water until these parameters stabilize as specified above. If the parameters of interest in the investigation include VOCs, care must be taken to ensure that purging does not induce degassing within the well. Where the well screen and sand pack are completely below the water table, the rate of purging should be controlled such that it does not draw the water level in the well below the top of the well screen. Where the well screen and sand pack are intersected by the groundwater level, the rate of purging should correspond with the rate of sampling, if continuous sampling methods are used. Large drawdowns in water table wells should be avoided. Purged groundwater that has a reasonable potential of containing hazardous substances shall be captured and characterized prior to discharge or disposal (see Section 5.5.1, below). Record the time after each well volume has been purged in order to keep track of actual pumping rate.

5.3.2 Samples for Major Cation, Metal, and Metallic Radionuclide Analyses

Samples for major cation, metal, and metallic radionuclide analyses (including Se) shall be immediately filtered after acquisition. Filtration is best accomplished with the use of an in-line filter system in which the sample is directly fed from the discharge port of a positive-pressure pump through the filter and into the appropriate sample bottle. A less preferred but acceptable method is the collection of an adequate amount of sample from a permissible positive-pressure pump or bailer into a properly cleaned and prepared high-density linear polyethylene or glass bottle. Samples shall be immediately fed through the filter and collected directly into the appropriate sample bottle. The final filter pore size should be 0.45 micron. (Note: New filters shall be used for each sample, and the filter system must be decontaminated before and after each sample.) These groundwater samples shall be preserved after filtration with nitric acid ($HN0_3$) to a pH less than 2.

In addition, if toxic metal or priority pollutant metal analyses are to be performed, an unfiltered sample will also be obtained (in addition to the filtered sample) directly from a permissible positive-pressure pump discharge port or from the bailer into appropriate sample bottles and preserved with nitric acid ($HN0_3$) to a pH less than 2. The only exception is analysis of chromium VI, in which case preservatives shall not be added to the sample.

5.3.3 Samples for Cyanide Analyses

Samples for cyanide analyses shall be collected directly into appropriate sample bottles from the bailer or the port of a positive-pressure pump. Samples shall not be filtered nor shall they be allowed to overflow the sample bottle. Samples shall be immediately preserved with sodium hydroxide (NaOH) to a pH greater than 12.

5.3.4 Samples for Major Anion and Biological Oxygen Demand (BOD) Analyses

Samples for major anions (chloride, fluoride, sulfate, alkalinity, acidity, total silica, bromfide) and for biological oxygen demand shall be collected directly into appropriate sample bottles from the port of the pump or from the bailer. These samples do not require filtration, but may be filtered, if desired. Preservatives shall not be added.

5.3.5 Samples for Total Phosphate and Orthophosphate Analyses

Groundwater samples for total phosphate and orthophosphate analyses shall be immediately filtered after initial sample acquisition. Filtration is best accomplished with an in-line system in which a positive-pressure pump discharge port feeds groundwater directly through the filter system into an appropriate sample bottle. A less preferred but acceptable method is to collect a liter of sample from a positive-pressure pump or bailer in a properly cleaned and prepared high-density polyethylene or glass bottle, and than immediately feed the sample through a filter system which discharges into the appropriate sample bottle. The final filter pore size shall be 0.45 micron. (Note: New filters must be used for each sample and the filter system must be decontaminated before and after each use.) Samples shall be immediately preserved with sulfuric acid (H_2SO_4) to pH less than 2.

5.3.6 Samples for Nitrogen Compound, Chemical Oxygen Demand, Oil and Grease, and Total Organic Carbon Analyses

Groundwater samples for nitrogen compound, chemical oxygen demand, oil and grease, and total organic carbon analyses shall be collected directly into appropriate sample bottles from a permissible positive pressure pump discharge port or from the bailer. These samples shall not be filtered and shall be preserved with sulfuric acid (H_2SO_4) to a pH less than 2.

5.3.7 Samples for Analysis of Total Dissolved Solids

Groundwater samples for analyses of total dissolved solids shall be immediately filtered in the field by methods discussed in Section 5.3.3 above, and collected directly into an appropriate sample bottle. Samples shall not be preserved with additives.

5.4 Field Analyses

5.4.1 Calibration of Instruments

All instruments used for field analyses shall be calibrated prior to use and daily during use. Only equipment with a calibration tag showing a recall date later than the anticipated date of use shall be taken to the field. Each instrument should be accompanied by a copy of the manufacturer's operation manual.

5.4.2 Water Temperature

A pocket thermometer or other measuring device shall be used to measure the temperature of the water on an aliquot of purged water obtained just before or after sampling. The thermometer reading shall be allowed to stabilize and shall be recorded to the nearest 0.5 degree centigrade. The instrument shall be rinsed with distilled or deionized water before and after each use.

5.4.3 pH Measurement

A pH meter shall be used to measure the pH of the sample on sample of purged water that was obtained just before or after sampling. Measurements shall be made immediately on the obtained sample (note: if possible, measure pH continuously on the purged water in a closed flow-through system). Calibration shall be in accordance with the manufacturer's procedures (provided with the instrument). Calibration shall be performed with standardized buffered pH solutions bracketing the range of expected pH and conducted at the beginning and end of each day. Before and after each reading, the probe shall be thoroughly rinsed with distilled or deionized water. The pH shall be recorded to one-tenth (or one-hundredth if the meter is stable enough) of a pH unit.

5.4.4 Conductivity Measurement

A conductivity probe shall be used for conductivity measurement on an aliquot of purged water obtained just before or after sampling. Measurements shall be made as soon as possible on the obtained aliquot. The meter shall be calibrated in accordance with manufacturer's procedures (provided with the instrument) with standardized KCl solutions. At a minimum calibration shall be performed at the beginning and ending of each days use. The conductivity shall be recorded to two significant figures. The temperature of the sample at the time of conductivity measurement shall also be recorded. The probe must be thoroughly rinsed with distilled/deionized water before and after each use.

5.4.5 Dissolved Oxygen Measurement

A dissolved oxygen meter is used to measure dissolved oxygen (DO) in water samples. Measurements shall be made immediately on aliquots obtained just before or after sample acquisition. (Note: If possible, measure DO continuously on the purge water in a closed flow-through system). The meter shall be calibrated in accordance with the manufacturer's procedures (provided with the instrument) using distilled/deionized water that has been allowed to equilibrate with the atmosphere at a given elevation. The salinity adjust shall be adjusted to the appropriate salinity of the water. Measure the temperature and concentration of dissolved oxygen in the sample while the salinity is on the fresh setting. The probe must be thoroughly rinsed with distilled or deionized water before and after each use. Measurements shall be recorded to the nearest 0.1 ppm concentration.

5.4.6 Turbidity Measurements

A turbidity meter shall be used to make turbidity measurements on aliquots of water samples obtained just before or after sample acquisition. Measurements shall be made as soon as possible on the obtained aliquot. Operation and calibration shall be in accordance with the manufacturer's procedures (provided with the instrument). Standardized solutions shall be used for calibration. The instrument shall be calibrated at least once during the purging and sampling of each well. The outside of the glass vials used for containing the aliquot for measurement must be wiped thoroughly dry before and after each use. Measurements shall be recorded to the nearest 0.1 NTU when less than 1 NTU; the nearest 1 NTU when between 1 and 10 NTU; and the nearest 10 NTU when between 10 and 100 NTU.

5.5 Capture And Disposal Of Purge Water And Decontamination Solutions

5.5.1 Purge Water

If specified in the applicable workplan or SAP, purged groundwater shall be captured and contained in 55 gallon steel drums or suitable tank(s). If so required, each drum or tank containing captured purge water shall be properly labeled with a weatherproof label as to the contents, the well(s) from which the contained purge water originated and the date in which the contents were generated. Storage of the drums or tanks shall be as specified in the project work documents or as directed by the Project Manager.

Captured and contained purge water shall be characterized for discharge, treatment and/or disposal. Characterization of the captured and contained purge water should be specified in the project work documents or by the Project Manager, but could rely on the analytical results of groundwater samples associated with each drum or tank, or could involve direct sampling and analyses of the contained water.

The requirements and options available for discharge, treatment and/or disposal are dependent upon many variables such as chemical consistency, local and state regulations, and location of site. Discharge, treatment, and/or disposal of captured and contained purge water must be in accordance with local, state and Federal regulations and shall be specified in the project work documents.

5.5.2 Decontamination Waste Solutions

Decontamination waste solutions that are generated during groundwater sampling include: spent detergent wash solutions; spent tap water rinses; any spent weak acid rinses, any spent methanol rinses; and spent final distilled/deionized water rinses. All spent acid and methanol rinses shall be captured and contained in plastic buckets or drums. Other spent decontamination waste solutions shall be captured and contained in appropriately sized buckets or drums if a reasonable potential exists for the spent solutions to contain hazardous substances. Project work documents shall address, or the Project Manager shall determine, whether spent decontamination solution requires capture and containment.

Captured and contained decontamination waste solutions shall be subject to the same procedures as described for purge water. Some noteworthy differences are as follows: (1) all acid solutions shall be neutralized with lime prior to discharge or disposal; (2) methanol solutions may be able to be evaporated if segregated from other waste solutions, if generated in small enough quantities, and if conditions are favorable; and (3) if quantities are sufficiently small, decontamination waste solutions (detergent washes, rinse waters, neutralized acid solutions) may be added to the captured and contained purge water that corresponds to the same well sampling effort.

5.6 Documentation

Documentation for sampling groundwater includes labeling sample bottles, and completing Groundwater Purging and Sampling Forms, and Chain of Custody Records, and securing individual samples or sample coolers with chain of custody seals.

5.6.1 Sample Labels

Samples shall be immediately labeled. Labels shall be waterproof. Information shall be recorded on each label with indelible ink. All blanks shall be filled in (N/A if not applicable). Groundwater sample designations shall be as specified in the governing workplan or SAP.

5.6.2 Groundwater Purging and Sampling Forms

Groundwater Purging and Sampling Forms (Appendix A) shall be used by the Field Sampling Engineer to record daily activities. Data shall be recorded on the Groundwater Purging and Sampling Form in chronological format. The time of each recorded event shall be included. The original Groundwater Purging and Sampling Form shall be submitted as soon as possible to the Project Manager or Task Leader.

5.6.4 Field Log Book

The field logbook is used by the Field Sampling Engineer to document the official raw field information for each sample that will be chemically analyzed. The original must be submitted as soon as possible to the Project Manager or Task Leader.

5.6.5 Chain of Custody Records

Sampling handling and chain of custody protocols shall be as specified in the governing workplan or SAP. Chain of custody records will normally be used to record the custody and transfer of samples. Chain of custody forms are normally provided by the selected analytical laboratory. These forms shall be filled in completely (use N/A if not applicable). Tamper-proof seals shall be placed on either sample bottles or shipping coolers. The seal number shall be recorded on the Chain of Custody Form. The original form must accompany the samples to the analytical laboratory to be completed and returned to MWH for filing. A copy of the Chain of Custody

Record documenting the transfer of samples from the field shall be submitted to the Project Manager or Task Leader.

6.0 REFERENCES

ASTM, 1995, ASTM Standards On Environmental Sampling - (PCN - 03-418095-38). ASTM, Philadelphia, PA.

U.S. EPA, 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, U.S. EPA/ Office of Solid Waste, Washington D.C.

U.S. EPA, 1986, Test Methods for Evaluating Solid Waste - (SW-846). U.S. EPA/Office of Solid Waste, Washington, D.C.

Wood, W.W. (1976), Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents, Techniques of Water-Resources Investigations of the United states Geological Survey, Book 1, Collection of Water Data by Direct Measurement, Chapter D2.

APPENDIX A

GROUNDWATER PURGING AND SAMPLING FORM

GROUNDWATER PURGING AND SAMPLING FORM

Project No.:__________________ Project Name:________________________ Client:__________________

Location:____________________ Well No:___________________

Date_____________ Start Time_________ Weather__________

Depth to Water ___________ Measuring Point __________

Water Column Height ___________ Well Dia. ____________

Sampling Method: Submersible Pump ☐ Centrifugal Pump ☐ Peristaltic Pump ☐ Other ☐ ☐

Bottom Valve Bailer ☐ Double Check Valve Bailer ☐ Stainless-Steel Kemmerer ☐

Criteria: 3 to 5 Casing Volumes of Water Removal ☐ Stabilization of Indicator Parameters ☐ Other_____________

	Water Volume in Well		
Gal/ft x ft of water	Gallons	Ounces	Gal/oz to be removed

Time (military)	pH (su)	SC (umhos/cm)	Temp (°C)	ORP (millivolts)	D.O. (mg/L)	Turbidity (NTU)	Vol Evac. (gal.)	Comments/ Flow rate

Final: Time	pH	SC	Temp	Eh-ORP	D.O.	Turbidity	Ferrous Iron	Vol Evac.	Comments/Flow Rate

COMMENTS:

INSTRUMENTATION: pH Meter ☐ _________________ Temperature Meter ☐ _________

DO Monitor ☐ _________________ Other ☐ _________

Conductivity Meter _________________

Water Disposal_________________________________

*Sample ID*____

Sample Date ___________________________ *Sample Time*______________________

APPENDIX B – COMMENTS AND COMMENT RESPOSE DOCUMENTS

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

444 Hospital Way #300 • Pocatello, Idaho • 83201

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

3 August 2009

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 2,* July 2009

Dear Mr. Koch,

The Agencies and Tribes have reviewed the *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 2,* July 2009, submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117. With incorporation of the minor changes listed below the *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 2* is approved. Please provide pertinent pages (e.g., spine and cover sheets, title page) for incorporation into Revision 2 indicating the document is final. We will also need a new pdf file of the final document.

Please let me know if you have any questions. I can be reached at 208-236-6160 or electronically at michael.rowe@deq.idaho.gov.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

Enclosure

cc: Robert Geddes (P4/Monsanto)
Cary Foulk (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Printed on Recycled Paper

Agencies and Tribes Comments on
2009 Groundwater Monitoring Sampling and Analysis Plan,
Revision 2, July 2009
3 August 2009

General Comments

None

Specific Comments

2-1. Table 2-1, page 2-5, Step 4, Temporal boundary. When explaining the decision factors for sampling in the fall, it might make sense, and would be more consistent, to use the new language found in Section 3.3.3, paragraph 1 on page 3-13.

Appendices

Field Sampling Plan
2-2. Table 4-1. Add other parameters to be analyzed such as gross alpha and gross beta, hardness, and total suspended solids.

Editorial Comments

Section 2.0, page 2-1, paragraph 3, line 3. Change *principle* to "principal."
Table 2-1, page 2-5, Step 3, bullet 7. It appears that this bullet would be improved by insertion of a comma(s), such as "existing site characterization, groundwater quality sampling and analysis plans and procedures".
Table 2-1, page 2-6, Step 4, Practical Constraints. Delete the comma and insert a closing parenthesis after *MDS034*.
Table 2-1, page 2-6, Step 5, Principal Study Question #3, line 2. Insert a comma for the last *and* to read ". . . groundwater and surface water, aid in review . . ."
Table 2-1, page 2-7, Step 7, line 2. Change *is* to "are."
Section 3.3.2, page 3-11, bullet 5 (Dump seeps, springs, and streams), line 6. Change *bee* to "be."
Section 3.3.3, page 3-13, paragraph 3 (last), line 4. Add a period after criteria and capitalize *these* to read ". . . groundwater quality criteria. These locations . . ."

Appendices

Field Sampling Plan
Table 4-3, page 4-8, column 2. Add "MWs" after *2008* to read "2008 MWs & MMW009".
Table 4-5, pages 4-12 and 4-13. Change the title of the table to ". . . and 2009 Monitoring Wells".

Table 4-5, page 4-12, column 6. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, add "Cr" in the column beginning *Total Cd.*

Table 4-5, page 4-12, column 7. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, add "Fe" in the column beginning *Total Al.*

Table 4-7, page 4-17, column 10. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, delete *K* and *Na* in the column beginning *Dissolved Ca.*

Response to 3 August 2009 Agencies and Tribes Comments on the *2009 Groundwater Water Monitoring Sampling and Analysis Plan, Revision 2, 24 July* 2009

General Comments

None

Specific Comments

2-1. Table 2-1, page 2-5, Step 4, Temporal boundary. When explaining the decision factors for sampling in the fall, it might make sense, and would be more consistent, to use the new language found in Section 3.3.3, paragraph 1 on page 3-13.

Response: *Text has been revised to be consistent with the language found in section 3.3.3.*

Appendices

Field Sampling Plan

2-2. Table 4-1. Add other parameters to be analyzed such as gross alpha and gross beta, hardness, and total suspended solids.

Response: *Table has been revised to include all containers and parameters.*

Editorial Comments

Section 2.0, page 2-1, paragraph 3, line 3. Change *principle* to "principal."
Table 2-1, page 2-5, Step 3, bullet 7. It appears that this bullet would be improved by insertion of a comma(s), such as "existing site characterization, groundwater quality sampling and analysis plans and procedures".
Table 2-1, page 2-6, Step 4, Practical Constraints. Delete the comma and insert a closing parenthesis after *MDS034*.
Table 2-1, page 2-6, Step 5, Principal Study Question #3, line 2. Insert a comma for the last *and* to read ". . . groundwater and surface water, aid in review . . ."
Table 2-1, page 2-7, Step 7, line 2. Change *is* to "are."
Section 3.3.2, page 3-11, bullet 5 (Dump seeps, springs, and streams), line 6. Change *bee* to "be."
Section 3.3.3, page 3-13, paragraph 3 (last), line 4. Add a period after criteria and capitalize *these* to read ". . . groundwater quality criteria. These locations . . ."

Appendices

Field Sampling Plan

Table 4-3, page 4-8, column 2. Add “MWs” after *2008* to read “2008 MWs & MMW009”.

Table 4-5, pages 4-12 and 4-13. Change the title of the table to “. . . and 2009 Monitoring Wells”.

Table 4-5, page 4-12, column 6. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, add “Cr” in the column beginning *Total Cd*.

Table 4-5, page 4-12, column 7. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, add “Fe” in the column beginning *Total Al*.

Table 4-7, page 4-17, column 10. To be consistent with Table 3-3 in the SAP and Table 4-3 in the FSP, delete *K* and *Na* in the column beginning *Dissolved Ca*.

Response: *The editorial revisions have been made.*

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

444 Hospital Way #300 • Pocatello, Idaho • 83201

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

15 July 2009

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 1,* June 2009

Dear Mr. Koch,

The Agencies and Tribes have reviewed the *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 1,* June 2009, (*2009 GWSAP*) submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). This sampling and analysis plan supports continued groundwater data collection at monitoring wells, direct push borehole wells (pre-packs), and strategic seeps and springs for key water quality parameters.

Although the Agencies and Tribes conditionally approved Revision 0 of the *2009 GWSAP* (28 May 09 e-mail from Michael Rowe to Barry Koch), Revision 1 has additional new language regarding groundwater sites to sample in the fall. Thus, final approval will occur after successful resolution of Agency and Tribal comments provided below.

The *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 1,* June 2009, is considered a deliverable under the CO/AOC, and per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing." In observance of our review process, I will schedule time on the Monday, 20 July 2009, conference call to answer any questions you might have on the Agency/Tribal comments. Subsequently, the next version of the *2009 Groundwater Monitoring Sampling and Analysis Plan* is due no later than 19 August 2009.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and Tribes, discussions to resolve those issues should be initiated. However, after the Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

Please let me know if you have any questions. I can be reached at 208-236-6160 or electronically at michael.rowe@deq.idaho.gov.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

Enclosure

cc: Robert Geddes (P4/Monsanto)
Cary Foulk (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Agencies and Tribes Comments on
2009 Groundwater Monitoring Sampling and Analysis Plan,
Revision 1, June 2009
15 July 2009

General Comments

1-A. All major changes between revisions of the document should be underlined to assist in Agency/Tribal review.

Specific Comments

(EPA) 0-1. Table 2-1, page 2-5, DQO Step 4. The description for the "Temporal boundary" should be revised to be consistent with the following comment on Section 3.3.3 and Table 3-4 (see below).

(IDEQ) 0-2. Table 3-3, page 3-10. Monitoring wells drilled in 2009 will be part of a summer/fall sampling event and do not need to be sampled for the expanded list of analytes. Sampling for the expanded list of analytes for wells drilled in 2009 should be done in Spring 2010.

(IDEQ) 0-3. Section 3.3.3, page 3-13, and Table 3-4, pages 3-15 and 3-16. Based on increases in both selenium and sulfate, P4/Monsanto has recommended the following wells or surface-expressions-of-groundwater (seeps, springs, headwater streams; SEGW) be sampled as part of a fall event.

- MDS030
- MMW021
- MSG004
- MSG006
- MST069

The Agencies and Tribes are of the opinion that there is no need to sample MMW021 or MSG006. The increase in selenium at MMW021 was only 0.005 mg/L (0.049 to 0.0495 mg/L) from spring to fall in 2008. For the same time period sulfate appeared to increase only 0.6 mg/L (1.3%) from 44.6 to 45.2 mg/L. Although both selenium and sulfate were higher in the fall, we do not think the increases justify fall sampling at MMW021. While in 2004 MSG006 saw increases in selenium and sulfate from spring to fall, concentrations of selenium and sulfate decreased from spring to fall in both 2007 and 2008. Thus, we feel there is little, if anything, to gain by sampling MSG006 in both the spring and fall.

We recommend that the basis to select 2009 fall groundwater sample locations be expanded to include regulatory criteria (selenium primary constituent standard and sulfate secondary constituent standard), a lack of historical fall sample data, and rising trends in concentration as criteria for deciding if 2009 fall sampling should occur at a given location. Based on these criteria, we recommend that the following 9 groundwater monitoring locations be sampled in Fall 2009, if not dry (e.g., MDS025, MDS034, and MST144).

1) Past samples that appear substantially higher in fall than spring and exceed selenium criterion and/or sulfate criterion
   a) MDS026
   b) MDS030
   c) MMW010
   d) MMW013
   e) MST069

2) Fall samples have never been collected and available spring samples exceed selenium criterion and/or sulfate criterion
   a) MDS025
   b) MDS034
   c) MST144

3) Other potential SEGW that appear substantially higher in fall than spring but are below criterion
   a) MSG004

Based on results from future monitoring events, other wells or SEGW may be added to the list of sites to be sampled in the fall. For example, only data from Fall 2008 are available for MMW027 and MMW029 when concentrations of selenium at these two wells were well above the groundwater quality criterion (0.3140 and 0.8060 mg/L, respectively). Should selenium concentration data from Spring 2009 be substantially lower than the Fall 2008 data, it would make sense to add these two wells to the list of sites for fall monitoring. Another example is MST136. If at some point spring concentrations of selenium exceed the groundwater quality criterion, it should be considered for fall sampling as a SEGW in those years when it is not dry in the fall.

(IDEQ) 0-4. Table 3-4, page 3-14. Please indicate the units (mg/L (?)) for the maximum concentrations presented in the table.

Editorial Comments

Table 2-1, page 2-7, footnote. *2* should be a superscript.
Table 3-2, page 3-7, footnote 2, line 3. Change *were* to "where."

Appendices
Appendix A (Field Sampling Plan), Section 4.2.2, page 4-2, paragraph 6, line 2. Change *ml* to 'mL."

Response to 15 July 2009 Agencies and Tribes Comments on the *2009 Groundwater Water Monitoring Sampling and Analysis Plan, Revision 1, 09 June* 2009

General Comments

I-A. All major changes between revisions of the document should be underlined to assist in Agency/Tribal review.

Response: *Comment noted. All major changes between Revision 1 and Revision 2 of the document are underlined to assist A/T review. Underlining associated with the previous revision has been removed.*

Specific Comments

(EPA) 0-1. Table 2-1, page 2-5, DQO Step 4. The description for the "Temporal boundary" should be revised to be consistent with the following comment on Section 3.3.3 and Table 3-4 (see below).

Response: *Table 2-1, page 2-5, DQO Step 4 has been revised to be consistent with Section 3.3.3.*

(IDEQ) 0-2. Table 3-3, page 3-10. Monitoring wells drilled in 2009 will be part of a summer/fall sampling event and do not need to be sampled for the expanded list of analytes. Sampling for the expanded list of analytes for wells drilled in 2009 should be done in Spring 2010.

Response: *Monitoring wells installed in fall 2009 will be sampled following development in fall 2009 for the regular list of analytes as are required for the direct push boreholes. We also understand and agree that the 2009 wells will be sampled in the spring 2010 for the expanded analyte list.*

(IDEQ) 0-3. Section 3.3.3, page 3-13, and Table 3-4, pages 3-15 and 3-16. Based on increases in both selenium and sulfate, P4/Monsanto has recommended the following wells or surface-expressions-of-groundwater (seeps, springs, headwater streams; SEGW) be sampled as part of a fall event.

- MDS030
- MMW021
- MSG004
- MSG006
- MST069

The Agencies and Tribes are of the opinion that there is no need to sample MMW021 or MSG006. The increase in selenium at MMW021 was only 0.005 mg/L (0.049 to 0.0495 mg/L) from spring to fall in 2008. For the same time period sulfate appeared to increase only 0.6 mg/L (1.3%) from 44.6 to 45.2 mg/L. Although both selenium and sulfate were higher in the fall, we do not think the increases justify fall sampling at MMW021. While in 2004 MSG006 saw increases in selenium and sulfate from spring to fall, concentrations of selenium and sulfate decreased from spring to fall in both 2007 and 2008. Thus, we feel there is little, if anything, to gain by sampling MSG006 in both the spring and fall.

We recommend that the basis to select 2009 fall groundwater sample locations be expanded to include regulatory criteria (selenium primary constituent standard and sulfate secondary constituent standard), a lack of historical fall sample data, and rising trends in concentration as criteria for deciding if 2009 fall sampling should occur at a given location. Based on these criteria, we recommend that the following 9 groundwater monitoring locations be sampled in Fall 2009, if not dry (e.g., MDS025, MDS034, and MST144).

1) Past samples that appear substantially higher in fall than spring and exceed selenium criterion and/or sulfate criterion

a) MDS026
b) MDS030
c) MMW010
d) MMW013
e) MST069

2) Fall samples have never been collected and available spring samples exceed selenium criterion and/or sulfate criterion

a) MDS025
b) MDS034
c) MST144

3) Other potential SEGW that appear substantially higher in fall than spring but are below criterion

a) MSG004

Based on results from future monitoring events, other wells or SEGW may be added to the list of sites to be sampled in the fall. For example, only data from Fall 2008 are available for MMW027 and MMW029 when concentrations of selenium at these two wells were well above the groundwater quality criterion (0.3140 and 0.8060 mg/L, respectively). Should selenium concentration data from Spring 2009 be substantially lower than the Fall 2008 data, it would make sense to add these two wells to the list of sites for fall monitoring. Another example is MST136. If at some point spring concentrations of selenium exceed the groundwater quality criterion, it should be considered for fall sampling as a SEGW in those years when it is not dry in the fall.

Response: *We agree with IDEQ's rationale to remove MMW021 and MSG006 from the fall sampling event. In addition, we have added MDS025, MDS026, MDS034 MMW010, MMW013, and MST144 to the fall 2009 sampling list that already includes MDS030, MST069, and MSG004. Section 3.3.3 and Table 3-4 have been revised to be consistent with the fall sampling rationale outlined in the comment above. In addition, this section was revised to include a discussion of including wells MMW027 and MMW029 based on spring*

2009 sampling results and the inclusion of other stations in future monitoring events based upon potential future exceedances of the groundwater quality criteria.

(IDEQ) 0-4. Table 3-4, page 3-14. Please indicate the units (mg/L (?)) for the maximum concentrations presented in the table.

Response: *The units for the maximum concentrations are stated in the notes on the bottom of Table 3-4. As stated in the notes, concentrations are in mg/L.*

Editorial Comments
Table 2-1, page 2-7, footnote. 2 should be a superscript.
Table 3-2, page 3-7, footnote 2, line 3. Change *were* to "where."

Appendices
Appendix A (Field Sampling Plan), Section 4.2.2, page 4-2, paragraph 6, line 2. Change *ml* to 'mL."

Response: *The editorial revisions have been made.*

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

444 Hospital Way, #300 • Pocatello, Idaho 83201 • (208) 236-6160

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

21 May 2009

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 0,* May 2009

Dear Mr. Koch,

The Agencies and Tribes have reviewed the *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 0,* May 2009, (*2009 GWSAP*) submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). This sampling and analysis plan supports continued groundwater data collection at monitoring wells, direct push borehole wells (pre-packs), and strategic seeps and springs for key water quality parameters. Agency/Tribal comments on the *2009 GWSAP* are provided below.

The *2009 Groundwater Monitoring Sampling and Analysis Plan, Revision 0,* May 2009, is considered a deliverable under the CO/AOC, and per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing." In observance of our review process, I will schedule time on the Monday, 1 June 2009, conference call to answer any questions you might have on the Agency/Tribal comments. Subsequently, the next version of the *2009 Groundwater Monitoring Sampling and Analysis Plan* is due no later than 1 July 2009.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and

Tribes, discussions to resolve those issues should be initiated. However, after the Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

Please let me know if you have any questions. I can be reached at 208-236-6160 or electronically at michael.rowe@deq.idaho.gov.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

Enclosure

cc: Robert Geddes (P4/Monsanto)
Cary Foulk (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Agencies and Tribes Comments on
2009 Groundwater Monitoring Sampling and Analysis Plan,
Revision 0, May 2009
21 May 2009

General Comments

0-A. At our 14 April 2009 meeting, we talked about comparing spring vs fall concentrations of COPCs at groundwater sampling sites to evaluate the need for fall sampling similar to what was done for surface water. Please do so.

0-B. The Data Quality Objectives (DQOs) as written infer that the proposed groundwater sampling plan is primarily a monitoring effort for trend continuity to be used in a future Remedial Investigation/Feasibility Study. Revise the DQOs to clarify that since the groundwater investigation, as part of the site characterization, has been conducted in a phased approach, a good portion of the data collected under this plan will be used to determine fate and transport of COPCs and to help constrain the hydrogeological conceptual model for the identification of potential removal or remedial actions. While this language is included later in the document, it should also be reflected in the DQOs.

0-C. Please delete the word "inactive" when referring to the mine sites currently under a CERCLA CO/ AOC.

0-D. In several places in the document the text states that if analytical data indicate a value that is less than or equal to an associated water quality standard or criterion, then no further characterization is warranted. Please change the text to clarify that analytical values equal to an associated criterion are considered a violation of that criterion and as such would warrant further characterization or remediation.

0-E. Remember to underline major changes between revisions of the document.

Specific Comments

0-1. Section 1.0, page 1-1, paragraph 2, sentence 2. Please revise this sentence to reflect the ongoing monitoring outlined in this document is needed to complete the assessment of nature and extent of contamination, including COPCs other than or in addition to selenium. Since the groundwater investigation has been conducted in a phased approach, many of the groundwater monitoring wells are new and sufficient sampling has not been conducted to screen out COPCs.

0-2. Section 2.0, page 2-1, paragraph 5, sentence 2. The text states that "For this groundwater monitoring program, the data are primarily collected for the measurement of analyte levels in groundwater . . ." Please revise the text to clarify that the data are being collected primarily to characterize potential contamination and potential risk to human health and ecological receptors.

0-3. Table 2-1, Step 2, Principal Study Question #1. Please revise the statement to "Are *COPCs* in groundwater monitoring wells and surface expressions of groundwater that assist in groundwater characterization elevated above the appropriate screening levels *that may pose a risk to human health or ecological receptors*?"

0-4. Table 2-1, Step 2, Principal Study Question #1. The "alternative actions" under Principal Study Question #1 are expressed only as possible outcomes, not actions. Principal Study Question #1 is a decision problem, so each action should also identify a logical course of action in response to the possible outcome. The course of action should be consistent with actions described in the "decision statement."

0-5. Table 2-1, Step 2, Principal Study Question #1. In the "decision statement" for Step 2, the intent of the text appears to be to describe the leading edge of the plume. Whereas, the reader may confuse the term "boundary" with a "property boundary," the text should be revised and the term "boundary" deleted, as appropriate.

0-6. Table 2-1, Step 2, Principal Study Question #1, Decision statement. Please include a footnote referencing the source(s) of the appropriate screening levels or where that information is contained later in the document.

0-7. Table 2-1, Step 2, Principal Study Question #1, Decision statement. The text implies that should COPC concentrations be elevated in relation to background but below relevant water quality criteria then no further characterization is required. Please revise the text to clarify that this may not be the case if the data indicate increasing trends either temporally or spatially that could warrant further characterization (e.g., fate and transport).

0-8. Table 2-1, Step 2, Principal Study Question #2. As worded, it appears the data objective for continued sampling of the surface expressions of groundwater is to see if they are being adequately monitored. In other words, this data objective appears to be to monitor for the sake of monitoring. Please revise this section to reflect that since P4/Monsanto proposed to conduct the groundwater investigation in phases, and as new wells were added as recently as last fall and have yet to be sampled, continued monitoring of the surface expressions of groundwater is necessary to further constrain the hydrogeologic conceptual model and to help constrain the nature and extent of contamination.

0-9. Table 2-1, Step 2, Principal Study Question #3. Please revise the text to reflect that coincident sampling of surface water and groundwater is being conducted to identify potential interconnected systems that will aid in evaluation of fate and transport of COPCs and perhaps aid in targeting pathways for removal or remedial actions.

0-10. Table 2-1, Step 2, Principal Study Question #3. The "action" under Principal Study Question #3 appears to be incomplete. Given that the No Action alternative is based on the outcome that ". . . station data and analyte lists are of adequate quality, quantity, and in proper locations to determine the relationship (if any) between temporal changes in groundwater and surface water quality . . .", then the "action" alternative should indicate what action will be taken if the outcome is not of adequate quality, quantity, and in proper locations to determine the relationship (if any) between temporal changes in groundwater and surface water quality. Revise the "action" alternative to identify a logical course of action in response to the particular outcome, consistent with the course of action described in the "decision statement."

0-11. Table 2-1, Step 4, page 2-5. For clarification, the description for the "spatial boundaries" should be revised to include "surface water expressions of groundwater" as follows: "Groundwater monitoring locations, including surface water expressions of groundwater, characterizing impacted groundwater at Ballard, Henry, and Enoch Valley mine areas."

0-12. Table 2-1, Step 5, Principal Study Question #1. The parenthetical insertion "(where groundwater contributions are responsible for elevating surface water concentrations)" is unnecessary and should be deleted because this phrase, as stated, inaccurately limits the applicability of selenium cold water criteria of 0.005 mg/L to situations "where groundwater contributions are responsible for elevating surface water concentrations."

0-13. Table 2-1, Step 5, Principal Study Question #1. The text states "Other COPCs will be evaluated, but for groundwater, selenium has been found to be the best indicator of impacts associated with mine waste areas." Please revise the text to clarify that in general, selenium appears to be the driving COPC for the Ballard, Henry, and Enoch Valley Mines. There are other phosphate mine sites in the Blackfoot River watershed where other COPCs such as cadmium are the driver rather than selenium.

0-14. Table 2-1, Step 5, Principal Study Questions #2 and #3. Principal Study Questions #2 and #3 specifically identify temporal trends in groundwater and surface water as the focus of the study; however, the role of temporal trends is not included in the Analytical Approach of Step 5. The Analytical Approach for Principal Study Questions #2 and #3 should address how temporal trends may affect the analytical approach and decisions under Step 5.

0-15. Table 2-1, Step 6. The text states that "Analytical parameters will be compared to the applicable groundwater quality risk-based screening level." Please reference the appropriate sources identified later in this document through use of a footnote.

0-16. Table 2-1, Step 7. It is stated that "The sampling design will be further evaluated if groundwater quality monitoring suggests that the proposed locations and analytes are not sufficient to assist in groundwater characterization of the shallow aquifers." Would this not hold true for the medium (i.e., Dinwoody Fm) and deep (i.e., Wells Fm) aquifers, too? If not, why not? If so, please revise accordingly.

0-17. Section 3.2, page 3-2, bullet 2. In the referenced letter, aluminum and iron were included in the list of unfiltered analytes to sample for groundwater. Please add Al and Fe to this list.

0-18. Section 3.2.1, page 3-4. MMW009 must continue to be sampled for the parameters identified in the 16 September 2008 letter to P4/Monsanto regarding analytes for sampling in 2008. The requisite analytes were selected based upon past data and the fact mining at the Enoch Valley Mine was completed relatively recently and has not, in all probability, reached geochemical equilibrium, nor has enough time passed to definitively determine completed transport pathways.

0-19. Table 3-2. In its current form, the Table implies that each analyte has been sampled at each sample location listed in Table 3-2. If this is the case, then the text and table should specify that each analyte has been sampled at least once at each location; therefore, a blank cell should be noted accordingly. If, however, a specific analyte has not yet been sampled at a specific location, then the corresponding cell in the Table should clearly specify that the analyte has not been sampled at that location.

0-20. Table 3-2, page 3-7, footnote 1. Four locations are mentioned, but only two stations (MMW004 and MPW022) are footnoted. Please reconcile.

0-21. Section 3.3.1, page 3-8. The text discusses agricultural, domestic, and borehole monitoring wells, but these locations are not included on Table 3-2, as were the other groundwater sampling locations identified in Section 3.3.1 (that is, the production and monitoring wells, springs, and seeps are included in Table 3-2 but not the agricultural, domestic, and borehole monitoring wells). Revise the Table to include these locations or provide appropriate text explaining why they are not included in the Table.

0-22. Section 3.3.1. The following two monitoring wells appear to be strategically located within plumes on the west side of the Ballard Mine and should be added to the 2009 groundwater monitoring plan. Both wells should be sampled for the expanded list of analytes, consistent with the other project monitoring wells.

- MW-15A. MW-15A should be included in the monitoring program because MW-15A is located at the toe of a potential source (MWD080), is highly contaminated with selenium, and there is only one other alluvial sample location (MBW028) in the area.

- MW-16A. MW-16A should be included in the monitoring program because MW-16A was elevated in selenium in 2008 and is downgradient of monitoring well MMW030 which was nondetect for selenium in fall 2008.

The following three stream locations should be included in the 2009 groundwater monitoring plan, assuming they are flowing and are confirmed to be representative of surface water expressions of groundwater potentially impacted by P4/Monsanto mine activities. Note that these locations are not included in the 2009 and 2010 surface water monitoring program, so are not redundant of surface water sampling efforts. These locations should be sampled for the list of analytes for springs and seeps.

- MST096, Ballard Mine. This monitoring location should be included because it currently represents the easternmost monitoring point for the southeast plume at MWD082 as portrayed on Drawing 27 of the *2007 & 2008 Data Summary Report — Draft* (MWH, March 2009).

- MST136 and MST144, Enoch Valley Mine. These monitoring locations should be included because both streams go dry in the fall suggesting they are potential expressions of groundwater, may represent groundwater monitoring points for the impacts from MWD092, are elevated in selenium, and the nearby 2008 direct push borehole samples did not exhibit detectable selenium.

0-23. Section 3.3.1, page 3-8, paragraph 4. It is stated that P4/Monsanto believes that water at MSG008 and MST069 is from the same source. Please provide necessary data to support this assertion.

0-24. Section 3.3.1, page 3-8, paragraph 4. It is proposed that MST069 be sampled as both a surface water and groundwater station. P4/Monsanto must recognize that the suite of analytes may differ for surface water and groundwater at MST069. In addition, the dissolved fraction is of most concern for surface water stations whereas the total fraction is more important at groundwater stations. This concern may be resolved in Section 3.3.2 where P4/Monsanto recommends that only unfiltered or total fractions be analyzed. Please indicate that MST069 will be sampled for both groundwater and surface water, which will require analysis of different suites of analytes and different fractions of those analytes.

0-25. Section 3.3.2, page 3-8, paragraph 6. This paragraph currently indicates that only unfiltered fractions will be analyzed. Revise the paragraph to be consistent with the list of filtered and unfiltered analytes indentified in Table 3-3.

0-26. Section 3.3.2, page 3-8. The A/T recommend the analyte list for the new wells anticipated to be drilled in the fall of 2009 be included in this section.

0-27. Table 3-3, page 3-10, row 1 (2008 monitoring wells), column 3. Add unfiltered Fe to the list of analytes to sample. Note that iron is listed in Table B-3 (page 3-12) and has a secondary constituent standard for groundwater.

0-28. Table 3-3, page 3-10, row 2 (Direct push borehole wells), column 3. Add unfiltered Cr and Fe to the list of analytes to sample per the 16 September 2008 letter from Mike Rowe to Barry Koch.

0-29. Table 3-3, page 3-10, row 4 (Seeps and springs), column 3. According to Table 3-2, total dissolved solids were high for many seeps and springs. Yet, P4/Monsanto does not propose to sample for it. Please provide rationale for not sampling TDS, which has a secondary constituent standard for groundwater.

Appendices

Field Sampling Plan
0-30. Tables 4-3, 4-4, 4-5, and 4-7, pages 4-8, 4-11, 4-12, and 4-16. Please revise these tables based on A/T's previous comments on Table 3-3 – unfiltered Fe in 2008 monitoring wells, unfiltered Cr and Fe in direct push borehole wells, and possibly TDS in seeps and springs.

Editorial Comments

Section 2.0, page 2-1, paragraph 1, line 5. The ending parenthesis should be outside the period.
Section 2.0, page 2-2, bullet 1, line 1. Capitalize *constituents.*
Section 2.0, page 2-2, bullet 1, line 3. Change *is* to "are."
Section 2.0, page 2-2, bullet 3, line 1. Delete *and.*
Table 2-1, Step 1, paragraph 1, line 1. Change *P4s* to "P4's."
Table 2-1, Step 1, bullet 1, line 1. Put a space between the hyphen and *COPCs.*
Table 2-1, Step 1, bullet 3, line 1. Delete *and.*
Table 2-1, Step 4, Temporal boundary, line 5. Insert "be" between *will* and *monitored.*
Section 3.2, page 3-2, bullet 4. Add a space between the comma and *thallium.*
Section 3.2.1, page 3-3, line 1. Insert "*Parameters*" after *Groundwater.*
Section 3.2.1, page 3-3, paragraph 2, line 5. Add a comma after *or in lieu of.*
Table 3-2, page 3-7, footnote 2, line 3. Change *were* to "where."
Table 3-2, page 3-7, footnote R. Change *Well* to "Wells."
Section 3.3.1, page 3-8, paragraph 2, line 1. Change *reason* to "reasons."
Table 3-3, page 3-10, row 1 (2008 monitoring wells), column 3. Change *Th* to "Tl."

Appendix A, Field Sampling Plan
Section 2.0, page 2-1, paragraph 2, line 8. Change *complimentary* to "complementary."
Section 4.1, page 4-1, paragraph 2, line 6. Eliminate the first *contacts*, after the word *agency.*
Section 4.1, page 4-1, paragraph 4, line 7. Add a comma after *i.e.*
Section 4.2.2., page 4-2, paragraph 6, line 2. Delete the period after *feet.*
Section 4.7, page 4-7, bullet 8. Delete the space between the first parentheses and *blank.*
Section 4.7, page 4-7, paragraph 2, line 1. Shouldn't it be **0905-MMW020-GW-F-1** rather than ***0905-MMW020-GW-1-F***?
Section 4.10, page 4-10, bullet 2. *Distilled water* should be deionized water as in bullet 1.

June 9, 2009

Response to 21 May 2009 Agencies and Tribes Comments on the *2009 Groundwater Water Monitoring Sampling and Analysis Plan, Revision 0, 06* May 2009

General Comments

0-A. At our 14 April 2009 meeting, we talked about comparing spring vs fall concentrations of COPCs at groundwater sampling sites to evaluate the need for fall sampling similar to what was done for surface water. Please do so.

> Response: *Section 3.3.3, Seasonal Sampling Evaluation, and Table 3-4, Summary of Selenium and Sulfate Concentrations and Seasonal Sampling Evaluation, have been add to the SAP in order evaluate and list stations that will be sampled in the spring and fall 2009.*

0-B. The Data Quality Objectives (DQOs) as written infer that the proposed groundwater sampling plan is primarily a monitoring effort for trend continuity to be used in a future Remedial Investigation/Feasibility Study. Revise the DQOs to clarify that since the groundwater investigation, as part of the site characterization, has been conducted in a phased approach, a good portion of the data collected under this plan will be used to determine fate and transport of COPCs and to help constrain the hydrogeological conceptual model for the identification of potential removal or remedial actions. While this language is included later in the document, it should also be reflected in the DQOs.

> Response: *Table 2-1, Step 1 states "Continued monitoring is needed to assist in determination of the nature and extent of selenium impacts in groundwater. In addition, the groundwater monitoring provides beneficial information regarding groundwater/surface water interaction, which will assist in refinement of the hydrogeologic conceptual models of the Sites." Although this section is not worded exactly the same as the comment, we believe that it states similar objectives. However, the section has been revised to make it more consistent with the A/T comment and include other potential COPC impacts as well as include the identification of potential removal or remedial actions.*

0-C. Please delete the word "inactive" when referring to the mine sites currently under a CERCLA CO/ AOC.

> Response: *This word only appeared once in the SAP introduction in order to refer to the inactive P4 properties, collectively referred to as the Sites, as was approved in the 2009 and 2010 Surface Water Monitoring Plan (MWH, 2009). However, the word "inactive" has been removed from the first paragraph in Section 1.0 to address this comment.*

0-D. In several places in the document the text states that if analytical data indicate a value that is less than or equal to an associated water quality standard or criterion, then no further characterization is warranted. Please change the text to clarify that analytical values equal to an associated criterion are considered a violation of that criterion and as such would warrant further characterization or remediation.

Response: *There were only two uses of this scenario as they applied to principal study question #1 in Table 2-1. In addition, IDAPA 58.01.11 200. Groundwater Quality Standards, states that the "following numerical and narrative standards apply to all ground water of the state and shall not be exceeded unless otherwise allowed in this rule". The rules do not address a value equal to the criterion as a violation of this criterion. However, P4 has revised the decision rules for principal study question #1 to address this comment.*

0-E. Remember to underline major changes between revisions of the document.

Response: *Agreed, significant changes in the revised documents have been underlined.*

Specific Comments

0-1. Section 1.0, page 1-1, paragraph 2, sentence 2. Please revise this sentence to reflect the ongoing monitoring outlined in this document is needed to complete the assessment of nature and extent of contamination, including COPCs other than or in addition to selenium. Since the groundwater investigation has been conducted in a phased approach, many of the groundwater monitoring wells are new and sufficient sampling has not been conducted to screen out COPCs.

Response: *Section 1.0, page 1-1, paragraph 2, sentence 2 has been revised to include COPCs other than selenium.*

0-2. Section 2.0, page 2-1, paragraph 5, sentence 2. The text states that "For this groundwater monitoring program, the data are primarily collected for the measurement of analyte levels in groundwater . . ." Please revise the text to clarify that the data are being collected primarily to characterize potential contamination and potential risk to human health and ecological receptors.

Response: *Section 2.0, page 2-1, paragraph 5, sentence 2 has been revised to state "For this groundwater monitoring program, the data are primarily collected for the measurement of analyte levels in groundwater to characterize potential contamination and potential risk to human health and ecological receptors…"*

0-3. Table 2-1, Step 2, Principal Study Question #1. Please revise the statement to "Are *COPCs* in groundwater monitoring wells and surface expressions of groundwater that assist in groundwater characterization elevated above the appropriate screening levels *that may pose a risk to human health or ecological receptors*?"

> Response: *Table 2-1, Step 2, Principal Study Question #1 has been revised to state "Are COPCs in groundwater monitoring wells and surface expressions of groundwater that assist in groundwater characterization elevated above the appropriate screening levels*[1] *that may pose a risk to human health or ecological receptors?"*

0-4. Table 2-1, Step 2, Principal Study Question #1. The "alternative actions" under Principal Study Question #1 are expressed only as possible outcomes, not actions. Principal Study Question #1 is a decision problem, so each action should also identify a logical course of action in response to the possible outcome. The course of action should be consistent with actions described in the "decision statement."

> Response: *Table 2-1, Step 2, Principal Study Question #1. The alternative actions have been revised to address this comment.*

0-5. Table 2-1, Step 2, Principal Study Question #1. In the "decision statement" for Step 2, the intent of the text appears to be to describe the leading edge of the plume. Whereas, the reader may confuse the term "boundary" with a "property boundary," the text should be revised and the term "boundary" deleted, as appropriate.

> Response: *Table 2-1, Step 2, Principal Study Question #1 has been revised to remove the term "boundary" and refer to the "edge of the plume."*

0-6. Table 2-1, Step 2, Principal Study Question #1, Decision statement. Please include a footnote referencing the source(s) of the appropriate screening levels or where that information is contained later in the document.

> Response: *Table 2-1, Step 2, Principal Study Question #1. The decision statement has been revised to include a footnote referencing Table 3-1, Achievable Laboratory Limits and Applicable Project Screening Values Groundwater Parameters.*

0-7. Table 2-1, Step 2, Principal Study Question #1, Decision statement. The text implies that should COPC concentrations be elevated in relation to background but below relevant water quality criteria then no further characterization is required. Please revise the text to clarify that this may not be the case if the data indicate increasing trends either

---

[1] Table 3-1, *Achievable Laboratory Limits and Applicable Project Screening Values Groundwater Parameters,* contains the applicable risk-based screening levels.

temporally or spatially that could warrant further characterization (e.g., fate and transport).

Response: *Table 2-1, Step 2, Principal Study Question #1. The decision statement has been revised to address this comment.*

0-8. Table 2-1, Step 2, Principal Study Question #2. As worded, it appears the data objective for continued sampling of the surface expressions of groundwater is to see if they are being adequately monitored. In other words, this data objective appears to be to monitor for the sake of monitoring. Please revise this section to reflect that since P4/Monsanto proposed to conduct the groundwater investigation in phases, and as new wells were added as recently as last fall and have yet to be sampled, continued monitoring of the surface expressions of groundwater is necessary to further constrain the hydrogeologic conceptual model and to help constrain the nature and extent of contamination.

Response: *Table 2-1, Step 2, Principal Study Question #2 has been revised to address this comment.*

0-9. Table 2-1, Step 2, Principal Study Question #3. Please revise the text to reflect that coincident sampling of surface water and groundwater is being conducted to identify potential interconnected systems that will aid in evaluation of fate and transport of COPCs and perhaps aid in targeting pathways for removal or remedial actions.

Response: *Table 2-1, Step 2, Principal Study Question #3 has been revised to address this comment.*

0-10. Table 2-1, Step 2, Principal Study Question #3. The "action" under Principal Study Question #3 appears to be incomplete. Given that the No Action alternative is based on the outcome that ". . . station data and analyte lists are of adequate quality, quantity, and in proper locations to determine the relationship (if any) between temporal changes in groundwater and surface water quality . . .", then the "action" alternative should indicate what action will be taken if the outcome is not of adequate quality, quantity, and in proper locations to determine the relationship (if any) between temporal changes in groundwater and surface water quality. Revise the "action" alternative to identify a logical course of action in response to the particular outcome, consistent with the course of action described in the "decision statement."

Response: *Table 2-1, Step 2, Principal Study Question #3. The action alternatives have been revised to include an outcome consistent with the decision statement.*

0-11. Table 2-1, Step 4, page 2-5. For clarification, the description for the "spatial boundaries" should be revised to include "surface water expressions of groundwater" as follows: "Groundwater monitoring locations, including surface water expressions of groundwater, characterizing impacted groundwater at Ballard, Henry, and Enoch Valley mine areas."

Response: *Table 2-1, Step 4 has been revised to include this language*.

0-12. Table 2-1, Step 5, Principal Study Question #1. The parenthetical insertion "(where groundwater contributions are responsible for elevating surface water concentrations)" is unnecessary and should be deleted because this phrase, as stated, inaccurately limits the applicability of selenium cold water criteria of 0.005 mg/L to situations "where groundwater contributions are responsible for elevating surface water concentrations."

Response: *Table 2-1, Step 5, Principal Study Question #1 has been revised to remove the parenthetical insertion.*

0-13. Table 2-1, Step 5, Principal Study Question #1. The text states "Other COPCs will be evaluated, but for groundwater, selenium has been found to be the best indicator of impacts associated with mine waste areas." Please revise the text to clarify that in general, selenium appears to be the driving COPC for the Ballard, Henry, and Enoch Valley Mines. There are other phosphate mine sites in the Blackfoot River watershed where other COPCs such as cadmium are the driver rather than selenium.

Response: *Table 2-1, Step 5, Principal Study Question #1 has been revised to state "Other COPCs will be evaluated, but for groundwater at P4's sites, selenium has been found to be the best indicator of impacts associated with mine waste areas."*

0-14. Table 2-1, Step 5, Principal Study Questions #2 and #3. Principal Study Questions #2 and #3 specifically identify temporal trends in groundwater and surface water as the focus of the study; however, the role of temporal trends is not included in the Analytical Approach of Step 5. The Analytical Approach for Principal Study Questions #2 and #3 should address how temporal trends may affect the analytical approach and decisions under Step 5.

Response: *Table 2-1, Step 5, Principal Study Questions #2 and #3 have been revised to discuss how temporal trends may affect the analytical approach and decisions.*

0-15. Table 2-1, Step 6. The text states that "Analytical parameters will be compared to the applicable groundwater quality risk-based screening level." Please reference the appropriate sources identified later in this document through use of a footnote.

Response: *Table 2-1, Step 6 has been revised to include a footnote referencing Table 3-1, Achievable Laboratory Limits and Applicable Project Screening Values Groundwater Parameters.*

0-16. Table 2-1, Step 7. It is stated that "The sampling design will be further evaluated if groundwater quality monitoring suggests that the proposed locations and analytes are not sufficient to assist in groundwater characterization of the shallow aquifers." Would this not hold true for the medium (i.e., Dinwoody Fm) and deep (i.e., Wells Fm) aquifers, too? If not, why not? If so, please revise accordingly.

Response: *Table 2-1, Step 7 has been revised to remove the reference to "shallow aquifers" and make the statement more general to address site-wide groundwater.*

0-17. Section 3.2, page 3-2, bullet 2. In the referenced letter, aluminum and iron were included in the list of unfiltered analytes to sample for groundwater. Please add Al and Fe to this list.

Response: *Aluminum and iron have been added to Section 3.2, page 3-2, bullet 2.*

0-18. Section 3.2.1, page 3-4. MMW009 must continue to be sampled for the parameters identified in the 16 September 2008 letter to P4/Monsanto regarding analytes for sampling in 2008. The requisite analytes were selected based upon past data and the fact mining at the Enoch Valley Mine was completed relatively recently and has not, in all probability, reached geochemical equilibrium, nor has enough time passed to definitively determine completed transport pathways.

Response: *It is proposed that MMW009 be analyzed for the expanded list of analytes similar to the 2008 and 2009 monitoring wells. This list is a more exhaustive list compared to the parameters identified in the 16 September 2008 letter to P4/Monsanto. Section 3.0 of the SAP as well as the FSP have been revised to reflect this change.*

0-19. Table 3-2. In its current form, the Table implies that each analyte has been sampled at each sample location listed in Table 3-2. If this is the case, then the text and table should specify that each analyte has been sampled at least once at each location; therefore, a blank cell should be noted accordingly. If, however, a specific analyte has not yet been sampled at a specific location, then the corresponding cell in the Table should clearly specify that the analyte has not been sampled at that location.

Response: *Table 3-2 has been revised to identify whether a specific analyte has or has not been sampled at a specific location.*

0-20. Table 3-2, page 3-7, footnote 1. Four locations are mentioned, but only two stations (MMW004 and MPW022) are footnoted. Please reconcile.

Response: *Table 3-2, page 3-7, footnote 1 has been changed to address this comment.*

0-21. Section 3.3.1, page 3-8. The text discusses agricultural, domestic, and borehole monitoring wells, but these locations are not included on Table 3-2, as were the other groundwater sampling locations identified in Section 3.3.1 (that is, the production and monitoring wells, springs, and seeps are included in Table 3-2 but not the agricultural, domestic, and borehole monitoring wells). Revise the Table to include these locations or provide appropriate text explaining why they are not included in the Table.

Response: *Language has been added to the final paragraph of Section 3.2.1 below Table 3-2 to address this comment. Section 3.3.1 refers to location selection and did not seem like an appropriate section to address this comment as it pertains to analytical screening.*

0-22. Section 3.3.1. The following two monitoring wells appear to be strategically located within plumes on the west side of the Ballard Mine and should be added to the 2009 groundwater monitoring plan. Both wells should be sampled for the expanded list of analytes, consistent with the other project monitoring wells.

- <u>MW-15A</u>. MW-15A should be included in the monitoring program because MW-15A is located at the toe of a potential source (MWD080), is highly contaminated with selenium, and there is only one other alluvial sample location (MBW028) in the area.

- <u>MW-16A</u>. MW-16A should be included in the monitoring program because MW-16A was elevated in selenium in 2008 and is downgradient of monitoring well MMW030 which was nondetect for selenium in fall 2008.

The following three stream locations should be included in the 2009 groundwater monitoring plan, assuming they are flowing and are confirmed to be representative of surface water expressions of groundwater potentially impacted by P4/Monsanto mine activities. Note that these locations are not included in the 2009 and 2010 surface water monitoring program, so are not redundant of surface water sampling efforts. These locations should be sampled for the list of analytes for springs and seeps.

- <u>MST096</u>, Ballard Mine. This monitoring location should be included because it currently represents the easternmost monitoring point for the southeast plume at MWD082 as portrayed on Drawing 27 of the *2007 & 2008 Data Summary Report — Draft* (MWH, March 2009).

- <u>MST136 and MST144</u>, Enoch Valley Mine. These monitoring locations should be included because both streams go dry in the fall suggesting they are potential expressions of groundwater, may represent groundwater monitoring points for the impacts from MWD092, are elevated in selenium, and the nearby 2008 direct push borehole samples did not exhibit detectable selenium.

Response: *Section 3.0 of the SAP and the FSP have been revised to include MW-15A and MW-16A with the 2008 and 2009 monitoring wells, which will be sampled for the expanded analyte list. In addition, stream locations MST096, MST136, and MST144 have been added to SAP and FSP. However, we disagree with the statement that because MST136 and MST144 go dry in the fall, that these locations are potential expressions of groundwater. The typical conceptual model is that if a stream location dries up in the summer and fall, then it is likely that the source of the water is from runoff and shallow interflow water. It would be expected that a stream location being recharged by groundwater would report a base flow throughout the year.*

0-23. Section 3.3.1, page 3-8, paragraph 4. It is stated that P4/Monsanto believes that water at MSG008 and MST069 is from the same source. Please provide necessary data to support this assertion.

Response: *MSG008 exits the ground through a pipe in such a way that it parallels then intersects with MST069 channel. In addition, both locations have similar geochemical concentrations; however, MST069 has higher Se and SO_4 concentrations (approximately a factor of two to three) compared to MSG008. For this reason, MST069 will be sampled under both the surface water and groundwater monitoring programs.*

0-24. Section 3.3.1, page 3-8, paragraph 4. It is proposed that MST069 be sampled as both a surface water and groundwater station. P4/Monsanto must recognize that the suite of analytes may differ for surface water and groundwater at MST069. In addition, the dissolved fraction is of most concern for surface water stations whereas the total fraction is more important at groundwater stations. This concern may be resolved in Section 3.3.2 where P4/Monsanto recommends that only unfiltered or total fractions be analyzed. Please indicate that MST069 will be sampled for both groundwater and surface water, which will require analysis of different suites of analytes and different fractions of those analytes.

Response: *Section 3.0 of the SAP and the FSP have been revised to include MST069 in both the surface water and groundwater monitoring programs, which requires a different suite of constituents.*

0-25. Section 3.3.2, page 3-8, paragraph 6. This paragraph currently indicates that only unfiltered fractions will be analyzed. Revise the paragraph to be consistent with the list of filtered and unfiltered analytes indentified in Table 3-3.

Response: *Section 3.3.2, paragraph 6 has been revised to clarify that the unfiltered fractions for metals will be analyzed. As shown on Table 3-3, other analytes will be filtered, as needed.*

0-26. Section 3.3.2, page 3-8. The A/T recommend the analyte list for the new wells anticipated to be drilled in the fall of 2009 be included in this section.

Response: *These wells are included in Section 3.0 and the FSP. Table 3-3 has been revised to include the proposed 2009 wells.*

0-27. Table 3-3, page 3-10, row 1 (2008 monitoring wells), column 3. Add unfiltered Fe to the list of analytes to sample. Note that iron is listed in Table B-3 (page 3-12) and has a secondary constituent standard for groundwater.

Response: *Table 3-3, row 1 (2008 monitoring wells), column 3 has been revised to include unfiltered iron.*

0-28. Table 3-3, page 3-10, row 2 (Direct push borehole wells), column 3. Add unfiltered Cr and Fe to the list of analytes to sample per the 16 September 2008 letter from Mike Rowe to Barry Koch.

Response: *Table 3-3, row 2 (Direct push borehole wells), column 3 has been revised to include unfiltered iron and chromium.*

0-29. Table 3-3, page 3-10, row 4 (Seeps and springs), column 3. According to Table 3-2, total dissolved solids were high for many seeps and springs. Yet, P4/Monsanto does not propose to sample for it. Please provide rationale for not sampling TDS, which has a secondary constituent standard for groundwater.

Response: *TDS was inadvertently left out of this table. Table 3-3 and the FSP have been revised to include TDS for seeps, springs, and streams.*

Appendices

Field Sampling Plan

0-30. Tables 4-3, 4-4, 4-5, and 4-7, pages 4-8, 4-11, 4-12, and 4-16. Please revise these tables based on A/T's previous comments on Table 3-3 – unfiltered Fe in 2008 monitoring wells, unfiltered Cr and Fe in direct push borehole wells, and possibly TDS in seeps and springs.

Response: *The FSP has been revised to address changes to Section 3.0 and Table 3-3 of the SAP.*

Editorial Comments

Section 2.0, page 2-1, paragraph 1, line 5. The ending parenthesis should be outside the period.
Section 2.0, page 2-2, bullet 1, line 1. Capitalize *constituents*.
Section 2.0, page 2-2, bullet 1, line 3. Change *is* to "are."
Section 2.0, page 2-2, bullet 3, line 1. Delete *and*.
Table 2-1, Step 1, paragraph 1, line 1. Change *P4s* to "P4's."
Table 2-1, Step 1, bullet 1, line 1. Put a space between the hyphen and *COPCs*.
Table 2-1, Step 1, bullet 3, line 1. Delete *and*.
Table 2-1, Step 4, Temporal boundary, line 5. Insert "be" between *will* and *monitored*.
Section 3.2, page 3-2, bullet 4. Add a space between the comma and *thallium*.
Section 3.2.1, page 3-3, line 1. Insert "*Parameters*" after *Groundwater*.
Section 3.2.1, page 3-3, paragraph 2, line 5. Add a comma after *or in lieu of*.
Table 3-2, page 3-7, footnote 2, line 3. Change *were* to "where."
Table 3-2, page 3-7, footnote R. Change *Well* to "Wells."
Section 3.3.1, page 3-8, paragraph 2, line 1. Change *reason* to "reasons."
Table 3-3, page 3-10, row 1 (2008 monitoring wells), column 3. Change *Th* to "Tl."

Appendix A, Field Sampling Plan
Section 2.0, page 2-1, paragraph 2, line 8. Change *complimentary* to "complementary."
Section 4.1, page 4-1, paragraph 2, line 6. Eliminate the first *contacts*, after the word *agency*.
Section 4.1, page 4-1, paragraph 4, line 7. Add a comma after *i.e.*
Section 4.2.2., page 4-2, paragraph 6, line 2. Delete the period after *feet*.
Section 4.7, page 4-7, bullet 8. Delete the space between the first parentheses and *blank*.
Section 4.7, page 4-7, paragraph 2, line 1. Shouldn't it be **0905-MMW020-GW-F-1** rather than ***0905-MMW020-GW-1-F***?
Section 4.10, page 4-10, bullet 2. *Distilled water* should be deionized water as in bullet 1.

Response: *The editorial revisions have been made.*

ATTACHMENT 3
2010 GROUNDWATER MONITORING MEMORANDUM

MWH

BUILDING A BETTER WORLD

May 14, 2010

Mr. Dave Tomten
US Environmental Protection Agency
1435 N. Orchard Street
Boise, ID 83706

RE: Transmittal of Final 2010 Groundwater Monitoring Memorandum - Revision 2

Dear Dave:

This letter transmits the final *2010 Groundwater Monitoring Memorandum - Revision 2*. This final version of the document addresses the four additional minor comments included in the A/T's conditional approval letter, dated May 13, 2010.

The document has been revised to address the A/T's first and third comments as suggested. With regards to the A/T's second and fourth comments, the text on pages 4 and 6 has been revised to further discuss sampling at MMW012 and MBW112 should groundwater be present. As stated in the revised text, alluvial monitoring well MMW012 and alluvial direct-push borehole well MBW112 have never had sufficient water in them for sampling or development. Given the low snow pack and runoff in 2010, there is no reason to believe that they will contain groundwater this year either. However, the water level in the monitoring wells will be checked. If groundwater is present in either of these wells, the height of the water column in the well will be determined, and the wells will be purged. If the wells recover following purging, the field team will contact the P4 and MWH project managers who will then contact the A/T. In consultation with the A/T, it will be determined if the wells should be sampled and for what analytes. This decision will be based in part on how much water is in the well (e.g., could more than one sample bottle be filled), observed turbidity, recovery, and etc. As this is the final version of the memorandum, these changes to the memorandum have not been underlined.

We are submitting these documents both electronically and hardcopy per the CO/AOC and subsequent agreements between the A/T and P4 Production. We have appreciated your timely review of the draft memorandum and comment responses. P4 anticipates sampling to begin as early as May 15. Should you have any questions, please contact Barry Koch at (208)547-1439.

Best Regards,

Cary Foulk

Cary L. Foulk
Supervising Geologist/Geochemist

1475 Pine Grove Road
Suite 109
Steamboat Springs, CO 80477
TEL 970 879 6260
FAX 970 879 9048
www.mwhglobal.com

Distribution:

Dave Tomten, USEPA
Tim Mosko, CH2M Hill
Michael Rowe, IDEQ
Mary Kauffman, USDA-FS

James Alexander, USDA
Jeff Cundick, BLM
Kelly Wright, Shoshone-Bannock Tribes
Sandi Arena, USFWS
Eldine Stevens, BIA
Susan Hanson
Barry Koch, Monsanto
Dave Farnsworth, Monsanto
Randy White, Monsanto
Cary Foulk, MWH
Vance Drain, MWH
Ruth Siegmund, MWH

Joe Wallace, USEPA
Lorraine Edmond, USEPA
Doug Tanner, IDEQ
Marcy Pearhill, IDEQ
Bruce Olenick, IDEQ
Gerry Winter, IDEQ
Jeff Jones, USDA-FS
Jason Sturm, BLM
Al Ruberry, IDL
Jim McCulloch, Monsanto
Mike Vice, Monsanto
Don Wind, Monsanto
Paul Stenhouse, Monsanto
Bob Geddes, Monsanto
Bruce Narloch, MWH
Leah Wolf-Martin, MWH
1007903@portal.mwhglobal.com
Celeste Christensen, MWH

Spring MSG005 at Ballard Mine

P4 Production

2010 Groundwater Monitoring Memorandum

Final

Prepared by

P4 Production, LLC

MWH

2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

May 2010

2010 GROUNDWATER MONITORING MEMORANDUM

Final
Revision 2

May 14, 2010

Prepared by:

MWH AMERICAS, INC.

Prepared for:

P4 PRODUCTION, LLC

TABLE OF CONTENTS

1.0 INTRODUCTION **1**

2.0 LOCATION SELECTION **2**

2.1 Monitoring Wells 2

2.2 Direct Push Borehole Wells 5

2.3 Production, Agricultural, and Domestic Wells 6

2.4 Dump Seeps, Springs, and Streams 6

3.0 ANALYTE SELECTION **7**

3.1 2009 Monitoring Wells 8

3.2 2008 & Older Monitoring Wells and Direct Push Borehole Wells 8

3.3 Potential Wells Installed in 2010 9

3.4 Production, Agricultural, and Domestic Wells 9

3.5 Dump Seeps, Springs, and Streams 9

4.0 SEASONAL SAMPLING EVALUATION **10**

5.0 SAMPLE COLLECTION AND ANALYSIS **11**

6.0 REFERENCES **13**

LIST OF TABLES (at end of document)

Table 1	2010 Groundwater Monitoring Locations, Frequency, and Schedule
Table 2	2010 Groundwater Proposed Analyte List
Table 3	Groundwater Analytical Summary
Table 4	Spring 2010 Sample Tracker for 2009 Monitoring Wells
Table 5	Fall 2010 Sample Tracker for 2009 Monitoring Wells
Table 6	Spring 2010 Sample Tracker for 2008 and Older Monitoring Wells and Direct Push Borehole Wells
Table 7	Fall 2010 Sample Tracker for 2008 and Older Monitoring Wells and Direct Push Borehole Wells
Table 8	Spring 2010 Sample Tracker for Seeps, Springs and Streams
Table 9	Fall 2010 Sample Tracker for Seeps, Springs and Streams
Table 10	Summary of Groundwater Analytical Results Spring and Fall 2009 Groundwater Monitoring

LIST OF DRAWINGS

Drawing 1 Location of Monitoring Wells

APPENDICES

Appendix A Document Comments and Responses

ACRONYMS AND ABBREVIATIONS

A/T	Agencies and Tribes
BLM	United States Bureau of Land Management
COPC	constituent of potential concern
CO/AOC	Administrative Settlement Agreement and Order on Consent/Consent Order
DOI	Department of the Interior
DQO	data quality objective
ER	equipment rinsate blank
FSP	Field Sampling Plan
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
MWH	MWH Americas, Inc.
P4	P4 Production, LLC
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SEGW	surface expression of groundwater
SOP	standard operating procedure
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service

1.0 INTRODUCTION

This memorandum describes the relevant components for the 2010 groundwater monitoring program at the P4 Production, L.L.C. (P4) mines near Soda Springs, Idaho. This memorandum was prepared by MWH Americas, Inc. (MWH) on behalf of P4 Production, LLC (P4), in accordance with the requirements of the Administrative Settlement Agreement and Order on Consent/Consent Order for Remedial Investigation/Feasibility Study (2009 CO/AOC; USEPA, 2009). The 2009 CO/AOC is a voluntary agreement between P4 and the United States Environmental Protection Agency (USEPA), the Idaho Department of Environmental Quality (IDEQ), the United States Department of Agriculture, Forest Service (USFS), the U.S. Department of the Interior (DOI), Bureau of Land Management (BLM), the Shoshone-Bannock Tribes (Tribes), collectively referred to as the "Agencies and Tribes" or A/T. This memorandum will be included as a component of the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) that supports the comprehensive mine-specific RI/FS that will be conducted at P4's three historic phosphate mines namely Ballard, Henry and Enoch Valley Mines (collectively, the "Sites").

Characterization of groundwater at the Sites has been conducted in a phased approach since 2004. Ongoing monitoring of contaminants of potential concern (COPC) concentrations and piezometric conditions in monitoring wells and specific seeps and springs is needed to complete characterization of the nature and extent of COPCs in groundwater. The groundwater data collected under this plan will support the RI/FS evaluation and refinement of the hydrogeologic conceptual models of the Sites.

As the substantive components of the 2010 groundwater monitoring program, including the Data Quality Objectives (DQOs) and methods and procedures are the same as the 2009 groundwater monitoring program, the complete components of an Sampling and Analysis Plan (SAP) are not included in this memorandum. The reader is referred to the *2009 Groundwater Monitoring Sampling and Analysis Plan* (*2009 Groundwater SAP;* MWH, 2009a) for the DQOs as well as the field sampling plan (FSP), quality assurance project plan (QAPP), and health and safety plan (HSP).

Similar to the *2009 Groundwater SAP,* P4 considered the following categories of groundwater monitoring locations: (1) monitoring wells, (2) direct push borehole monitoring wells, (3) production/domestic/agricultural wells, and (4) surface expressions of groundwater (SEGW) (e.g., dump seeps, springs, and streams) for 2010 monitoring. The categories were evaluated for spatial and analytical adequacy to characterize groundwater, as well as the amount of available data collected from 2004 onward.

2.0 LOCATION SELECTION

The spatial/categorical relevance of groundwater monitoring locations was evaluated. The purpose of this evaluation was to determine if various groundwater features, in close proximity, had similar chemical results. Based on the evaluation performed on the 2009 sampling data and the screening performed in the *2009 Groundwater SAP,* P4 recommends retaining or excluding the following locations, by category as discussed in the subsections below. Drawing 1 shows the water sampling locations for each of the mine sites. In addition, Table 1, *2010 Groundwater Monitoring Locations, Frequency, and Schedule* (replaces Table 3-1 from the *2009 Groundwater FSP*), lists the mine site followed by the locations to be sampled, and the year the wells were installed.

2.1 Monitoring Wells

P4 will sample MMW--- locations in 2010 except for the wells excluded as shown on Table 1. Water level measurements will continue to be collected from all MMW--- wells during the spring and fall 2010. Wells that have been replaced by new monitoring wells (e.g., MMW001) will also be excluded from sampling as well as from water level measurements. Wells MW-15A and MW-16A will be sampled at the Ballard Mine. These two wells were installed for the Blackfoot Bridge Environmental Impact Study baseline data collection program but are incorporated into the groundwater monitoring program for the RI/FS as of 2009 sampling events. Any wells installed in 2010 as part of the RI/FS process, will be sampled in fall 2010 after well development.

Several monitoring wells have been excluded from sampling in 2010. In general continued sampling of a monitoring well was not recommended if it was redundant (in the same flow path as another well), has been consistently dry, had a sufficiently long sampling record in location that was not impacted by the Sites, or would not be expected to vary during the period of the RI. The justification for excluding the specific monitoring wells is as follows:

MMW004: Monitoring well MMW004 is an old open borehole and steel cased well in the northern portion of the Henry Mine. It has been monitored since October 2004 during six sampling events. The selenium concentration has consistently been measured as being between 0.002 and 0.00273 mg/L, with one event having selenium not detected at 0.001 mg/L. Sulfate has also exhibited a narrow range of results over the six year period being between 112 and 137 mg/L. Concentrations over approximately 200 mg/L sulfate are typical but not conclusive of groundwater impacted by waste rock dump seepage. The data from this monitoring well are adequate for the RI/FS, and it is reasonable to assume the concentration will not be significantly different in 2010. Therefore, sampling was not recommended.

MMW014: Alluvial monitoring well MMW014 at the Henry Mine has been sampled during four monitoring events. The total selenium concentration has ranged from not detected at 0.001 mg/L to 0.00203 mg/L. The maximum sulfate concentration has been 61.9 mg/L. MMW014 is located very close to the toe of waste rock dump MWD090. Given the age of the waste rock dump, if there is an impact from the dump, it would have been observed in MMW014. Sufficient data have been collected from MMW014 for the RI/FS, and further sampling was not recommended.

MMW019: Monitoring well MMW019 at the Henry Mine is installed in shallow Phosphoria Formation. The maximum total selenium concentration from four sampling events has been 0.00541 mg/L and the maximum sulfate concentration 159 mg/L. Having been installed in the shallow Phosphoria Formation, which is not a key unit being characterized and not apparently impacted by the Henry Mine, further sampling is not recommended.

MMW008: Monitoring wells MMW007 and MMW008 are in the same hydrostratigraphic unit at the southern end of the Enoch Valley Mine (the upper weathered Dinwoody Formation/alluvial system). Neither monitoring well has produced groundwater samples suggestive of groundwater impacts from the mine. The maximum total selenium concentration measured in MMW008 was 0.00138 mg/L (four sampling events). Concentrations in MMW007 have been slightly higher with a maximum of 0.005 mg/L. With MMW007 in the same flow path and closer to the mine waste dump (the potential source), sampling of monitoring MMW008 is not necessary. It would become necessary if an impact in MMW007 was indicated.

MMW012: Alluvial monitoring well MMW012 is located at the Enoch Valley Mine and has never had sufficient water in it for sampling or development. Given the low snow pack and runoff in 2010, there is no reason to believe that it will contain groundwater this year either. However, the water level in the monitoring well will be checked. If groundwater is present in MMW012, the height of the water column in the well will be determined, and the well will be purged. If the well recovers following purging, the field team will contact the P4 and MWH project managers who will then contact the A/T. In consultation with the A/T, it will be determined if the well should be sampled and for what analytes. This decision will be based in part on how much water is in the well, observed turbidity, recovery, and etc.

MMW024: Monitoring wells MMW024 and MMW034 are in the same flow path at the Enoch Valley Mine. Both are Dinwoody Formation monitoring wells downgradient of waste rock dump MWD092. MMW034 is further downgradient from MMW024, which was installed adjacent to MWD092. Both monitoring wells have indicator parameters suggestive of impacts from the mine site. Selenium in MMW024 has been measured at 0.0137 and 0.0243 mg/L in May 2008 and September 2009, respectively. Measured selenium concentrations in the more downgradient MMW034 are actually a little higher at 0.0762 mg/L (September 2009). It appears that the plume of impacted groundwater has extended well beyond MMW024 to the area of MMW034. Sampling both of these closely placed monitoring wells in the same flow path during every event is not necessary, and MMW034 is further downgradient and has only been sampled once. Therefore, MMW024 has been dropped from the 2010 sampling.

MMW026: This monitoring well at the Enoch Valley Mine has been sample twice, once in September 2008 and then in May 2009. The concentrations of analytes that may suggest an impact from the Enoch Valley Mine were low and relatively invariant between the two events. For example, sulfate which is almost always elevated in mine-impacted groundwater was reported as 19.5 and 19.7 mg/L in May 2008 and September 2009, respectively. Total selenium measured in MMW026 was 0.0013 and 0.00107 mg/L in May 2008 and September 2009, respectively. Cadmium was not detected in either monitoring event. This monitoring well is key location for long-term monitoring of the Wells Formation and the Enoch Valley mine and will need to be sampled periodically. However, given the low concentrations and relatively consistent concentrations of the key indicator parameters, sampling in 2010 for the RI/FS appears unnecessary. Sampling in 2011 is suggested and that the monitoring well be included in a long-term monitoring program. However, the sampling frequency could be every other year so long as indicator parameters do not indicate an increasing trend.

2.2 Direct Push Borehole Wells

This groundwater monitoring category for 2010 includes the existing direct push borehole monitoring wells (pre-pack wells) installed during the 2008 and 2009 direct push groundwater investigation. At Ballard Mine, MBW006, -009, -011, -027, -028, -032, -048, -130, -131, and -135 will be monitored. At Enoch Valley Mine, MBW085, -087, -099, -107, will be monitored and at Henry Mine, MBW152 will be monitored.

Two direct push locations were excluded from sampling in 2010. One location that was excluded was where the location is redundant with another, and the well is positioned such that the data are not important to the RI. The second condition was where the well has been consistently dry. The following provides specific information on the locations excluded:

MBW026: This direct-push monitoring well at the Ballard Mine appears to be providing data redundant with co-located MBW027. The May 2009 selenium concentrations from MBW026 and MBW027 were 0.221 and 0.210 mg/L respectively. Water levels in these were approximately 1.3 feet different. Despite being installed at slightly different depths, the two monitoring wells appear to be monitoring the same hydrostratigraphic horizon and the same water quality. Further sampling of MBW026 was not recommended. It should be noted that this location also includes a deeper co-located conventional monitoring well, MMW017, which does appear to be monitor a separate portion of the alluvial system and has a slightly different water quality.

MBW112: This direct-push monitoring well has consistently been dry or not produced sufficient water to be sampled or developed. The water level will be checked in 2010. In all likelihood this location should be abandoned. If groundwater is present in MBW112, the height of the water column in the well will be determined, and the well will be purged. If the well recovers following purging, the field team will contact the P4 and MWH project managers who will then contact the A/T. In consultation with the A/T, it will be determined if the well should be sampled and for what analytes. This decision will be based in part on how much water is in the well, observed turbidity, recovery, and etc.

2.3 Production, Agricultural, and Domestic Wells

P4 excluded these wells (MPW-, MAW-, and MDW-) from the 2009 monitoring program and they will again be excluded from the 2010 monitoring program. P4 has a record of several sampling efforts for these locations and previous screening evaluations show no selenium exceedances in these production wells. Refer to Drawing 1 for the location of these wells.

2.4 Dump Seeps, Springs, and Streams

P4 will continue to monitor dumps seeps MDS025, -026, -030, and -034. Dumps seeps MDS025 and MDS026 at Enoch Valley Mine, show exceedances of selenium and other analytes. Additionally, MDS030 will be used as a surrogate for MDS031—033. P4 will continue to monitor MDS034 due to limited water quality data at this location.

P4 will continue to monitor MSG004—007. MSG001—003 will be excluded from future monitoring because P4 has a record of several sampling events for these locations. MSG001 and MSG002 have shown no selenium exceedances. P4 has monitored MSG003 seven times to date. MSG008, Hayfield Pipe, will not be monitored in 2009 because P4 believes this water to be from the same source as MST069, Short Creek, which is scheduled for continued monitoring under this groundwater plan and under the surface water monitoring program as described in the *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan* (*2009 Surface Water SAP;* MWH, 2009b). MSG008 also empties into the Short Creek channel, south of the haul road.

P4 will continue to monitor MST096 at Ballard mine as this location represents the easternmost monitoring point for the southeast plume at MWD082. In addition, location MST136 and MST144 at Enoch Valley will also be monitored to evaluate potential impacts from MWD092. Surface expressions of groundwater (headwater stream locations) were also evaluated for future performance monitoring in the *2009 Surface Water SAP*.

3.0 ANALYTE SELECTION

The analyte selection below presents the proposed analyte list for 2010 groundwater monitoring in Table 2, *2010 Groundwater Proposed Analyte List* (replaces Table 3-3 from the *2009 Groundwater SAP*) and Table 3, *Groundwater Analytical Summary* (replaces Table 4-3 from the *2009 Groundwater FSP*). Based on IDEQ and USEPA guidance, only unfiltered or total fractions will be analyzed for metals. While dissolved metal fractions have been measured in the past and are more useful for geochemical evaluations, they are not directly comparable to applicable IDEQ and USEPA screening benchmarks for groundwater. At this time, P4 believes that sufficient dissolved fraction metals data from a sufficient number of wells is available to make geochemical interpretations.

In direct-push boreholes, where samples "appear" to be non-turbid (<5 NTU), P4 will collect replicate samples for both total and dissolved analyses. However, if there is not enough water in the well, samples will be collected for total analyses only. In direct-push boreholes where turbidity is factor (>5 NTU), then samples will be collected for dissolved analyses (filtered) only.

Based on this direction, the proposed analytes for the 2010 groundwater monitoring are listed in Table 2. Further discussion of the analyte list, by groundwater monitoring location type is given below. In addition to the recommended analytes, P4 will also take physical water quality parameters including:

- pH
- Specific Conductivity;
- Dissolved oxygen;
- Oxidation/Reduction Potential;
- Turbidity; and
- Temperature.

3.1 2009 Monitoring Wells

The expanded analyte list (see Table 2) will be collected for the spring 2010 sampling event for the monitoring wells constructed in 2009. These wells were sampled for the regular analyte list in fall 2009 with the assumption that they would be sampled for the expanded analyte list in spring 2010. If any wells installed in 2009 require sampling in fall 2010 based on the seasonal evaluation described in Section 4.0, the wells would be sampled for the primary analyte list. The expanded analyte list was presented in Table B-3 from Appendix B, *2008 Phase IIb Monitoring Well Installation Technical Memorandum - Final,* dated April 2008 (MWH, 2008) with the exception of orthophosphate and ferrous/ferric iron. A copy of this table (Table B-3) is included in the tables section.

3.2 2008 & Older Monitoring Wells and Direct Push Borehole Wells

The 2008 and older monitoring wells and direct push borehole monitoring wells have been sampled for the expanded and regular analyte list in the past. The direct push borehole wells were sampled in 2009 for the regular list (presented in Table B-3 from Appendix B, *2008 Phase IIb Monitoring Well Installation Technical Memorandum - Final,* dated April 2008 [MWH, 2008]). The 2008 monitoring wells were sampled for the expanded list in 2009, and the 2007 and older monitoring wells were sampled for comprehensive list of parameters in 2008 and earlier events. Based on the 2009 sampling results as well as screening results presented in the *2009 Groundwater SAP,* isolated exceedances occurred for a few constituents. However, several exceedances were reported for Se, SO_4, TDS, and occasionally Cd when evaluated against primary and secondary screening benchmarks. Due to low numbers of isolated exceedances as well as low factors of exceedance, P4 proposes to sample 2008 and older monitoring wells as well as direct push borehole wells for Se, Cd, SO_4, and TDS (primary analyte list). This includes MMW009, this well has previously been sampled for the expanded analyte list, and screening against primary and secondary screening benchmarks has shown one exceedance of lead in 2008 (below lead standard in both 2007 and 2009) as well as exceedances of aluminum, iron, and manganese (regional background concerns). Based on this screening, MMW009 will be analyzed for the primary list in 2010, in addition to total lead. Metals analysis will be analyzed from the unfiltered, total fraction, unless excessive turbidity is encountered in the well (e.g., direct push borehole wells – total and dissolved analysis based on turbidity).

3.3 Potential Wells Installed in 2010

Wells that may be installed in 2010 as part of the RI/FS will be sampled for the regular analyte list (see Table 2). The regular analyte list is the non-asterisked analytes presented in Table B-3 from Appendix B, *2008 Phase IIb Monitoring Well Installation Technical Memorandum - Final,* dated April 2008 (MWH, 2008) with the exception of orthophosphate and ferrous/ferric iron. However, chromium will also be included in the analyte list for these potential 2010 wells. These wells may be sampled for the expanded list in future sampling events as indicated in future planning documents.

3.4 Production, Agricultural, and Domestic Wells

As discussed in Section 2.3, above, these wells were not sampled in 2009 and will not be sampled in 2010.

3.5 Dump Seeps, Springs, and Streams

The seep, spring, and stream analytes were selected based on screening performed in the *2009 Surface Water SAP* and *2009 Groundwater SAP*. Only five analytes showed any exceedances after primary and secondary screening. Total and dissolved fractions at seeps, springs, and streams will be analyzed because these locations can also be evaluated as surface water (see Table 2). Stream stations MST136 and MST069 will be sampled under both the groundwater and surface water program. This will require that the stations be sampled for slightly different suites and different fractions of analytes as required by both programs. In addition to the groundwater analytes, MS069 and MST136 will be sampled for the following per the 2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan (MWH, 2009b):

- Dissolved iron, potassium, sodium, vanadium, and zinc
- Alkalinity
- Hardness

4.0 SEASONAL SAMPLING EVALUATION

Based on A/T direction, P4 evaluated historic spring and fall selenium and sulfate data as detailed in the *2009 Groundwater SAP*. This evaluation supported the decision to sample some stations in the fall as well as the spring. The following locations were sampled in fall 2009 and will also be sampled again in fall 2010 based on the rationale provided below:

- Historic samples results are higher in the fall than the spring and exceed either the selenium or sulfate water quality criteria:
  - MDS026
  - MDS030
  - MMW010
  - MMW013
  - MMW029
  - MST069
- Fall samples results have never been collected and available spring data samples exceed the selenium or sulfate water quality criteria:
  - MDS025
  - MDS034
  - MST144

- Historic samples results are higher in the fall than the spring but are below either the selenium or sulfate water quality criteria:
    - MSG004

In addition, MST069 will be sampled under both the surface water and groundwater monitoring programs as stated in the *2009 Surface Water SAP*. It is also noted that if the pending spring 2010 data is significantly lower than the fall 2009 data for wells installed in 2009, then additional wells (e.g., MMW034 and MMW035) will be included in the fall 2010 sampling program. Tables 4 to 9 provide sampling tracking information for both the spring and fall locations and analyte lists. Table 10 provides the results for the 2009 groundwater sampling event.

5.0 SAMPLE COLLECTION AND ANALYSIS

In 2010, samples will be analyzed for the groundwater parameters presented in Table 3, *Groundwater Analytical Summary*. Microbac of Marietta, Ohio will analyze for all parameters listed according to the methods and procedures outlined in the *2009 Groundwater SAP*. Monitoring well samples will be collected using the protocols outlined in SOP-NW-5.3, *Collection of Groundwater Quality Samples* and the SOP *Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* and surface water samples will be collected according to SOP-NW-9.1, *Collection of Surface Water Samples*. All required SOPs are the same as those followed during 2009 and these SOPs provided in the *2009 Groundwater SAP*. The following QA/QC procedures will be followed during sampling, with changes from 2009 noted below:

- Collection of field replicate samples will occur at a minimum rate of 5 percent of total stations, compared to a rate of 10 percent historically. The field replicate will consist of two field duplicates in 2010 compared to field triplicates, historically.

- The equipment rinsate sample will be collected by rinsing decontaminated sampling equipment with deionized water in a manner similar to actual sample collection. Equipment rinsate samples (ERs) will be taken on a daily basis whenever non-dedicated sampling equipment is used. For example, wells have dedicated pumps or equipment and will not need an equipment rinsate sample taken. Surface water samples will require the collection of ER samples as non-dedicated sampling equipment may be used. If more than one team collects samples on a given day, ERs will also be taken by each sampling team.

- The source water blank will be a sample of the deionized water used for the equipment rinsate sample. Source water blank samples will be collected once at the beginning of each sampling event, and whenever new source water is used.

- For matrix spike analysis, field teams will collect additional volume and designate on the chain-of-custody forms that the samples are for matrix spike analysis. Matrix spike samples will be collected on a daily basis. Sufficient sample will be collected such that matrix spike/matrix spike duplicate pairs will be analyzed at a rate of 5 percent of field samples.

Refer to the *QAPP Addendum* (MWH, 2009c) for further details regarding groundwater sampling QA/QC procedures. The QA/QC samples as well as a summary of all samples are provided on Tables 4 though 9.

6.0 REFERENCES

MWH, 2008. *Conditional Final - 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models - Interim Report for Hydrogeologic Investigation.* July.

MWH, 2009a. *2009 Groundwater Monitoring Sampling and Analysis Plan.* Prepared for P4 Production. August.

MWH, 2009b. *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan.* Prepared for P4 Production. May.

MWH, 2009c. *Quality Assurance Project Plan Addendum Program Quality Assurance Plan.* Prepared for P4 Production. January.

TABLES

TABLE 1 2010 GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE							
Mine	Station Description	Station ID	Station Type	Well Installation Year	Groundwater System Monitored and Screened Interval (ft bgs)	Spring 2010	Fall 2010
Ballard	Short Creek	MBW006	BW	2008	Alluvial 14-9	x	
	Blackfoot River Road @ Monsanto Haul Road	MBW009	BW	2008	Alluvial 11-6	x	
	Ballard Creek	MBW011	BW	2008	Alluvial 15-10	x	
	Ballard, Western Shallow	MBW026	BW	2008	Alluvial 11-6	**	
	Ballard, Western Deeper	MBW027	BW	2008	Alluvial 16-11	x	
	Torgeson	MBW028	BW	2008	Alluvial 21-16	x	
	Holmgren	MBW032	BW	2008	Alluvial 15-10	x	
	Wooley Valley Creek	MBW048	BW	2008	Alluvial 9-4	x	
	East of Ballard Mine, along Wooley Valley Creek	MBW130	BW	2009	Alluvial 25-20	x	
	Northeast of Ballard Mine, near MST093	MBW131	BW	2009	Alluvial 8-3	x	
	Southeast of Ballard Mine, across Blackfoot River Road	MBW135	BW	2009	Alluvial 20-15	x	
	South of West Ballard Pit; south of waste rock dumps	MMW006	MW	2007	Wells Formation 330-310	x	
	Northwest of Ballard Mine into Long Valley Creek alluvial flow field	MMW017	MW	2007	Alluvial 56-36	x	
	East of Ballard Mine in Wooley Valley alluvial flow field	MMW018	MW	2007	Alluvial 33-18	x	
	East side of West Ballard Pit (MMP035); replacement of MMW001	MMW020	MW	2007	Wells Formation 408-388	x	
	West side of West Ballard Pit (MMP035); replacement of MMW002	MMW021	MW	2007	Wells Formation 250-230	x	
	East Ballard mine area in the vicinity of MMW018	MMW029	MW	2008	Dinwoody Formation 60-45	x	x
	Along the southwestern portion of Ballard Mine in the vicinity of MMW016A	MMW030	MW	2008	Wells Formation 155-135	x	
	Along the western perimeter of Ballard Mine in the vicinity and north of MMW017	MMW031	MW	2008	Wells Formation 200-180	x	
	Adjacent to MWD084	MMW032	MW	2009	Alluvial 65-55	x	TBD
	Deeper well nested with MMW029	MMW033	MW	2009	Dinwoody Formation 148 – 128	x	TBD
	West Ballard Mine near MST068	MW-15A	MW	2006	Alluvial 40-30	x	
	Southwest Ballard Mine near MST069	MW-16A	MW	2006	Alluvial 30-20	x	

TABLE 1

2010 GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE

Mine	Station Description	Station ID	Station Type	Well Installation Year	Groundwater System Monitored and Screened Interval (ft bgs)	Spring 2010	Fall 2010
	Ballard Mine, Pit #2 Upper Dump Seep	MDS030	DS	-	-	x	x
	Ballard Mine, Holmgren Spring	MSG004	SG	-	-	x	x
	Ballard Mine, Cattle Spring	MSG005	SG	-	-	x	
	Ballard Mine, Southeast Spring	MSG006	SG	-	-	x	
	Ballard Mine, South of Southeast Spring	MSG007	SG	-	-	x	
	Short Creek below Ballard Mine	MST069	ST	-	-	x	x
	Tributary of North Fork Wooley Valley Creek, below Ballard Mine	MST096	ST	-	-	x	
Henry	North Hnery Mine, along Little Blackfoot River	MBW152	BW	2009	Alluvial 15-10	x	
	Henry Mine, Dump Seep #3 (new for 2008)	MDS034	DS	-	-	x	x
	North of Henry Mine north pit	MMW004	MW	before 2007*	Alluvial/ Dinwoody Formation No screen	**	
	Southeast of Center Henry Pit; near MPW023	MMW010	MW	2007	Alluvial 32-12	x	x
	Northwest of Center Henry Pit; south of Little Blackfoot River	MMW011	MW	2007	Wells Formation 115-95	x	
	Southeast of Henry Mine center pit in Lone Pine Creek alluvial flow field	MMW014	MW	2007	Alluvial 22-7	**	
	North of Henry Mine center pit	MMW019	MW	2007	Alluvial 14-4	**	
	Northeast lobe of Henry Mine waste rock dump MWD086	MMW022	MW	2007	Dinwoody Formation 326-306	x	
	Henry Mine North Pit	MMW023	MW	2007	Wells Formation 357-352	x	
	Near the Little Blackfoot River northwest of MMW019	MMW028	MW	2008	Dinwoody Formation 96-76	x	
Enoch Valley	Rasmussen Creek	MBW085	BW	2008	Alluvial 12.25-7.25	x	
	Rasmussen Road and Agrium Haul Road intersection	MBW087	BW	2008	Alluvial 12-7	x	
	Agrium Haul Road North	MBW099	BW	2008	Alluvial 29-24	x	
	Western Enoch Valley, East of fence	MBW107	BW	2008	Alluvial 40-35	x	
	Western Enoch Valley ,West of fence	MBW112	BW	2008	Alluvial 18-13	***	
	Enoch Valley Mine, West Dump Seep	MDS025	DS	-	-	x	x
	Enoch Valley Mine, South Dump Seep	MDS026	DS	-	-	x	x
	South of EVM South Dump; near edge of dump footprint	MMW007	MW	2007	Alluvial 90-70	x	

TABLE 1 2010 GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE							
Mine	**Station Description**	**Station ID**	**Station Type**	**Well Installation Year**	**Groundwater System Monitored and Screened Interval (ft bgs)**	**Spring 2010**	**Fall 2010**
	South of EVM South Dump; south and downgradient of MMW007	MMW008	MW	2007	Alluvial/Dinwoody Formation 197-177	**	
	Central North Dump (MWD091)	MMW009	MW	2007	Wells Formation 554-549	x	
	Northwest of EVM North Dump in Lone Pine Creek alluvial flow field	MMW012	MW	2007	Alluvial 52-28	***	
	Southwest of EVM in Rasmussen Creek alluvial flow field	MMW013	MW	2007	Dinwoody Formation 35-25	x	x
	Along the south end of Enoch Valley Mine, near MMW013	MMW024	MW	2008	Dinwoody Formation 200-180	**	
	Along the south end of Enoch Valley Mine, near MMW007	MMW025	MW	2008	Dinwoody Formation 200-180	x	
	Northeast of MPW006/MMW008	MMW026	MW	2008	Wells Formation 355-335	**	
	Near MMW012	MMW027	MW	2008	Dinwoody Formation 120-100	x	
	Deeper well nested with MMW013	MMW034	MW	2009	Dinwoody Formation 156-136	x	TBD
	Deeper well nested with MMW027	MMW035	MW	2009	Dinwoody Formation 199 – 179	x	TBD
	Well west of MMW027	MMW036	MW	2009	Alluvial 135 – 115	x	TBD
	Rasmussen Creek headwaters near Enoch Valley Mine Shop Pond	MST136	ST	-	-	x	
	West Pond Creek headwaters, below West Pond	MST144	ST	-	-	x	x

Notes:

DS - Dump Seep
BW - Borehole Monitoring Well
SG - Spring
MW - Monitoring Well
ST – Stream
TBD – To Be Determined

* - Exact date of installation is not known
** - Water level to be monitored
*** - Water level to be monitored, if groundwater is present, sampling of this well will be considered following consultation with the A/T.

Will not be sampled in 2010

TABLE 2 2010 GROUNDWATER PROPOSED ANALYTE LIST		
Category	**Fraction**	**Analytes (Analytical Method)**
2009 monitoring wells (spring 2010 event only)		Expanded Analyte List
	Unfiltered	TDS (EPA 160.1)
	Unfiltered	TSS (EPA 160.2)
	Unfiltered	Al, Ba, Be, Fe, Mo, V (EPA 6010B)
	Unfiltered	Sb, As, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, Tl, U, Zn (EPA 6020A)
	Unfiltered	Hg (EPA 7471)
	Unfiltered	Gross alpha, gross beta (EPA 900)
	Filtered	Nitrogen - total nitrate-nitrite (EPA 353.2)
	Filtered	SO_4, Cl (EPA 300.0)
	Filtered	Ca, Fe, Mg, K, Na (EPA 6010B)
	Filtered	Alkalinity (EPA 310.2)
	Filtered	Hardness (SM2340B)
2008 & older monitoring wells and direct push borehole wells (excluding MMW009)		Primary Analyte List
	Unfiltered*	Cd, Se (EPA 6020A)
	Filtered	SO_4 (EPA 300.0)
	Unfiltered	TDS (EPA 160.1)
MMW009	Unfiltered	Cd, Se, Pb (EPA 6020A)
	Filtered	SO_4 (EPA 300.0)
	Unfiltered	TDS (EPA 160.1)
Potential 2010 wells		Regular Analyte List
	Unfiltered	TDS (EPA 160.1)
	Unfiltered	TSS (EPA 160.2)
	Unfiltered	Al, Fe, V (EPA 6010B)
	Unfiltered	Cd, Cr, Mn, Ni, Se, Zn (EPA 6020A)
	Unfiltered	Gross alpha, gross beta (EPA 900)
	Filtered	Nitrogen - total nitrate-nitrite (EPA 353.2)
	Filtered	SO_4, Cl (EPA 300.0)
	Filtered	Ca, Fe, Mg, K, Na (EPA 6010B)
	Filtered	Alkalinity (EPA 310.2)
	Filtered	Hardness (SM2340B)
Seeps, springs, and streams	Unfiltered	TDS (EPA 160.1)
	Unfiltered	Cd, Se (EPA 6020A)
	Unfiltered	V (EPA 6010B)
	Filtered	Cd (EPA 6020A)
	Filtered	Ca, Mg (EPA 6010B)
	Filtered	SO_4, Cl (EPA 300.0)

Notes:
Hardness is calculated on filtered fractions of Ca and Mg
Direct-push monitoring wells may be sampled for dissolved or dissolved and total fractions depending on turbidity (see Section 3 and Table 3).

TABLE 3 GROUNDWATER ANALYTICAL SUMMARY									
Parameter	2009 MW's	2008 & Older MWs & BW Wells	Potential 2010 Wells	Seeps , Springs, & Streams	Basis	Method	RL	Reporting Units	Holding Times (days)
alkalinity	x		x		total	310.2	10	mg/L	14
aluminum	x		x		total	6010B	0.1	mg/L	180
antimony	x				total	6020A	0.1	mg/L	180
arsenic	x				total	6020A	0.001	mg/L	180
barium	x				total	6010B	0.01	mg/L	180
beryllium	x				total	6010B	0.002	mg/L	180
cadmium		+		x	dissolved	6020A	0.0005	mg/L	180
cadmium	x	+	x	x	total	6020A	0.0005	mg/L	180
calcium	x		x	x	dissolved	6010B	0.2	mg/L	180
chloride	x		x	x	dissolved	300.0	0.2	mg/L	28
chromium	x		x		total	6020A	0.002	mg/L	180
cobalt	x				total	6020A	0.001	mg/L	180
copper	x				total	6020A	0.002	mg/L	180
gross alpha	x		x		total	900	5	pCi/L	180
gross beta	x		x		total	900	5	pCi/L	180
hardness	x		x		dissolved	2340B-Calculation	5	mg/L	n/a
iron	x		x		dissolved	6010B	0.1	mg/L	180
iron	x		x		total	6010B	0.1	mg/L	180
lead	x				total	6020A	0.001	mg/L	180
manganese	x		x		total	6020A	0.002	mg/L	180
magnesium	x		x	x	dissolved	6010B	0.5	mg/L	180
mercury	x				total	7471	0.002	mg/L	28
molybdenum	x				total	6010B	0.01	mg/L	180
nickel	x		x		total	6020A	0.004	mg/L	180
nitrogen (total nitrate – nitrite)	x		x		total	353.2	0.05	mg/L	28
potassium	x	x	x		dissolved	6010B	1	mg/L	180
selenium	x	+	x	x	total	6020A	0.001	mg/L	180
selenium		+			dissolved	6020A	0.001	mg/L	180
silver	x				total	6020A	0.001	mg/L	180
sodium	x		x		dissolved	6010B	0.5	mg/L	180
sulfate	x	x	x	x	dissolved	300.0	1	mg/L	28
thallium	x				total	6020A	0.0002	mg/L	180
total dissolved solids	x	x	x	x	total	160.1	10	mg/L	7
total suspended solids	x		x		total	160.2	5	mg/L	7

TABLE 3 GROUNDWATER ANALYTICAL SUMMARY									
Parameter	**2009 MW's**	**2008 & Older MWs & BW Wells**	**Potential 2010 Wells**	**Seeps , Springs, & Streams**	**Basis**	**Method**	**RL**	**Reporting Units**	**Holding Times (days)**
uranium	x				total	6020A	0.040	mg/L	180
vanadium	x		x	x	total	6010B	0.01	mg/L	180
zinc	x		x		total	6020A	0.025	mg/L	180

Notes:
X – Well sampled for this analyte
+ - Direct-push wells may be sampled also for dissolved selenium and cadmium if they have elevated turbidity (> 5 NTU), if low turbidity, they will be sampled for total and dissolved for there is sufficient water volume, otherwise a total sample will be collected.
Method - Method to be utilized by Microbac
MW - Monitoring Well
BW - Direct-Push Borehole Well
RL - Reporting Limit of Microbac

From Appendix B, *2008 Phase IIb Monitoring Well Installation Technical Memorandum – Final:*

Table B-3
2008 Groundwater Analytes for Existing Wells

Parameter	Method	EDL	Reporting Units	Holding Time (days)
alkalinity, total	SM2320B	2	mg/L	14
aluminum	M200.7 ICP	0.03	mg/L	180
antimony*	M200.8 ICP/MS	0.0004	mg/L	180
Arsenic*	M200.8 ICP/MS	0.0001	mg/L	180
Barium*	M200.7 ICP	0.0001	mg/L	180
beryllium*	M200.7 ICP	0.0001	mg/L	180
cadmium	M200.8 ICP/MS	0.0001	mg/L	180
calcium	M200.7 ICP	0.2	mg/L	180
chloride	M300.0	0.5	mg/L	28
chromium*	M200.8 ICP/MS	0.0001	mg/L	180
cobalt*	M200.7 ICP	0.01	mg/L	180
copper*	M200.7 ICP	0.01	mg/L	180
gross alpha	M900.0	2	pCi/L	180
gross beta	M900.0	4	pCi/L	180
hardness	Calculation	1.5	mg/L	-
iron	M200.7 ICP	0.01	mg/L	180
ferrous iron, dissolved (Field)	HACH	0.01	mg/L	-
ferric iron, dissolved	Calculation	0.01	mg/L	-
lead*	M200.8 ICP/MS	0.0001	mg/L	180
manganese	M200.8 ICP/MS	0.0005	mg/L	180
magnesium	M200.7 ICP	0.2	mg/L	180
mercury*	M245.1	0.0002	mg/L	28
molybdenum*	M200.7 ICP	0.01	mg/L	180
nickel	M200.8 ICP/MS	0.0006	mg/L	180
Nitrogen (total nitrate-nitrite)	M 353.2	0.02	mg/L	28
orthophosphate	M 365.1	0.005	mg/L	28
pH	M150.1	0.1	pH	-
potassium	M200.7 ICP	0.3	mg/L	180
selenium	SM3114 B, AA-Hydride	0.001	mg/L	180
silver*	M200.7 ICP	0.01	mg/L	180
sodium	M200.7 ICP	0.3	mg/L	180
sulfate	M300.0	0.5	mg/L	28
thallium*	M200.8 ICP/MS	0.0001	mg/L	180
total dissolved solids+	M160.1	10	mg/L	7
total suspended solids+	M160.1	10	mg/L	7
uranium*	M200.8 ICP/MS	0.0001	mg/L	180
vanadium	M200.8 ICP/MS	0.0002	mg/L	180
zinc	M200.8 ICP/MS	0.002	mg/L	180

* -- Analytes to be analyzed only in groundwater collected from monitoring wells MMW007, MMW009, MMW010, MMW012, MMW014, MMW017, and MMW018, and surface water at sites not previously sampled for the expanded list of analytes.
+ -- Analyte to be analyzed only in groundwater collected from monitoring well MMW009 and 5% of these monitoring wells: MMW001, MMW004, MMW009, MMW011, MMW013, MMW014, MMW017, MMW019, MMW020, and MMW022.
bicarbonate and carbonate to be analyzed only in groundwater collected from monitoring wells used for geochemical typing.
Methods are for media (non-blank) samples.
Equipment and field blanks will be analyzed for unfiltered results. For regulatory compliance, all media samples will be analyzed for unfiltered metals.
EDL – Estimated Detection Limit; the laboratory analytical limit does not reflect possible sample-specific elevation of the reporting limit due to dilution, contamination or other issues identified during the data validation process.

Table 4
Spring 2010 Sample Tracker for 2009 Monitoring Wells
(Page 1 of 1)

					Laboratory Parameters - Expanded Analyte List												Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Sb, As, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, Tl, U, Zn (SW6020A)	Total Al, Ba, Be, Fe Mo, V (SW6010B)	TDS (E160.1)	TSS (E160.2)	Hg (SW 7471)	Gross Alpha, Gross Beta (EPA 900)	Nitrate/nitrite as N (EPA 353.2)	Dissolved S04, Cl (EPA 300.0)	Dissolved Ca, Fe, Mg, K, Na (EPA 6010B)	Total Alkalinity (EPA 310.2)	Dissolved Hardness (SM2340B-Calc)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1005GWMMW032-U	MMW032	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
1005GWMMW032-F	MMW032	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
1005GWMMW033-U	MMW033	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
1005GWMMW033-F	MMW033	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
1005GWMMW034-1-U	MMW034	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
1005GWMMW034-1-F	MMW034	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
1005GWMMW034-2-U	MMW034	Water		Duplicate	X	X	X	X	X	X								X	X		X	X	X	X	X	
1005GWMMW034-2-F	MMW034	Water	X	Duplicate							X	X	X	X	X			X	X		X	X	X	X	X	
1005GWMMW035-U	MMW035	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
1005GWMMW035-F	MMW035	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
1005GWMMW036-U	MMW036	Water		Primary	X	X	X	X	X	X								X	X		X	X	X	X	X	
1005GWMMW036-F	MMW036	Water	X	Primary							X	X	X	X	X			X	X		X	X	X	X	X	
1005B-GW-10-U	na	Water		B	X	X	X	X	X	X																
1005B-GW-10-F	na	Water	X	B							X	X	X	X	X											

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

Primary QC sample indicates that it is the first samples collected.

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2010 would have a prefix of (1006) followed by the normal sample ID.

Table 5
Fall 2010 Sample Tracker for 2009 Monitoring Wells
(Page 1 of 1)

					Lab Parameters - Primary List				Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1009GWMMWTBD-U	TBD	Water		Primary	X	X				X	X		X	X	X	X	X	
1009GWMMWTBD-F	TBD	Water	X	Primary			X			X	X		X	X	X	X	X	
1009GWMMWTBD-U	TBD	Water		Primary	X	X				X	X		X	X	X	X	X	
1009GWMMWTBD-F	TBD	Water	X	Primary			X			X	X		X	X	X	X	X	
1009GWMMWTBD-U	TBD	Water		Primary	X	X				X	X		X	X	X	X	X	
1009GWMMWTBD-F	TBD	Water	X	Primary			X			X	X		X	X	X	X	X	
1009GWMMWTBD-U	TBD	Water		Primary	X	X				X	X		X	X	X	X	X	
1009GWMMWTBD-F	TBD	Water	X	Primary			X			X	X		X	X	X	X	X	
1009GWMMWTBD-U	TBD	Water		Primary	X	X				X	X		X	X	X	X	X	
1009GWMMWTBD-F	TBD	Water	X	Primary			X			X	X		X	X	X	X	X	
1009B-GW-10-U	na	Water		B	X	X												
1009B-GW-10-F	na	Water	X	B			X											

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.
ID - identification
na - not applicable
QC - quality control
Primary QC sample indicates that it is the first samples collected.
TBD - to be determined
[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2010 would have a prefix of (1006) followed by the normal sample ID.

Table 6
Spring 2010 Sample Tracker for 2008 and Older Monitoring Wells and Direct Push Borehole Wells
(Page 1 of 4)

					Lab Parameters - Primary Analyte List					Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)	Total Pb (SW6020A)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
10095GWMBW006-U	MBW006	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW006-F	MBW006	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW009-U	MBW009	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW009-F	MBW009	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW011-U	MBW011	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW011-F	MBW011	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW027-U	MBW027	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW027-F	MBW027	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW028-U	MBW028	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW028-F	MBW028	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW032-1-U	MBW032	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW032-1-F	MBW032	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW032-2-U	MBW032	Water		Duplicate	X	X					X	X		X	X	X	X	X	
10095GWMBW032-2-F	MBW032	Water	X	Duplicate	O	O	X				X	X		X	X	X	X	X	
10095GWMBW048-U	MBW048	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW048-F	MBW048	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW085-U	MBW085	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW085-F	MBW085	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW087-1-U	MBW087	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW087-1-F	MBW087	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW099-U	MBW099	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW099-F	MBW099	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
10095GWMBW107-U	MBW107	Water		Primary	X	X					X	X		X	X	X	X	X	
10095GWMBW107-F	MBW107	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	

Table 6
Spring 2010 Sample Tracker for 2008 and Older Monitoring Wells and Direct Push Borehole Wells
(Page 2 of 4)

					Lab Parameters - Primary Analyte List					Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)	Total Pb (SW6020A)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1005GWMBW130-U	MBW130	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMBW130-F	MBW130	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
1005GWMBW131-U	MBW131	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMBW131-F	MBW131	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
1005GWMBW135-U	MBW135	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMBW135-F	MBW135	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
1005GWMBW152-U	MBW152	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMBW152-F	MBW152	Water	X	Primary	O	O	X				X	X		X	X	X	X	X	
1005GWMMW006-U	MMW006	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW006-F	MMW006	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW007-U	MMW007	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW007-F	MMW007	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW008-U	MMW008	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW008-F	MMW008	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW009-U	MMW009	Water		Primary	X	X		X			X	X		X	X	X	X	X	
1005GWMMW009-F	MMW009	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW010-U	MMW010	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW010-F	MMW010	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW011-U	MMW011	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW011-F	MMW011	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW013-U	MMW013	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW013-F	MMW013	Water	X	Primary			X				X	X		X	X	X	X	X	

Table 6
Spring 2010 Sample Tracker for 2008 and Older Monitoring Wells and Direct Push Borehole Wells
(Page 3 of 4)

					Lab Parameters - Primary Analyte List					Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)	Total Pb (SW6020A)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1005GWMMW017-U	MMW017	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW017-F	MMW017	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW018-1-U	MMW018	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW018-1-F	MMW018	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW018-2-U	MMW018	Water		Duplicate	X	X					X	X		X	X	X	X	X	
1005GWMMW018-2-F	MMW018	Water	X	Duplicate			X				X	X		X	X	X	X	X	
1005GWMMW020-U	MMW020	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW020-F	MMW020	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW021-U	MMW021	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW021-F	MMW021	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW022-U	MMW022	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW022-F	MMW022	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW023-U	MMW023	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW023-F	MMW023	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW025-U	MMW025	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW025-F	MMW025	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW027-U	MMW027	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW027-F	MMW027	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW028-U	MMW028	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW028-F	MMW028	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW029-U	MMW029	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW029-F	MMW029	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW030-U	MMW030	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW030-F	MMW030	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMMW031-U	MMW031	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMMW031-F	MMW031	Water	X	Primary			X				X	X		X	X	X	X	X	

Table 6
Spring 2010 Sample Tracker for 2008 and Older Monitoring Wells and Direct Push Borehole Wells
(Page 4 of 4)

					Lab Parameters - Primary Analyte List					Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)	Total Pb (SW6020A)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1005GWMW-15A-U	MW-15A	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMW-15A-F	MW-15A	Water	X	Primary			X				X	X		X	X	X	X	X	
1005GWMW-16A-U	MW-16A	Water		Primary	X	X					X	X		X	X	X	X	X	
1005GWMW-16A-F	MW-16A	Water	X	Primary			X				X	X		X	X	X	X	X	
1005B-GW-05-U	na	Water		B	X	X													
1005B-GW-05-F	na	Water	X	B			X												

O - Direct-push monitoring wells will be sample for total and dissolved fraction when the turbidity is less than 5 NTU.

If the turbidity is greater than 5 NTU, then the sample will be analyzed for the dissolved fraction only.

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

Primary QC sample indicates that it is the first samples collected.

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2010 would have a prefix of (1006) followed by the normal sample ID.

Table 7
Fall 2010 Sample Tracker for 2008 and Older Monitoring Wells and Direct Push Borehole Wells
(Page 1 of 1)

					Lab Parameters - Primary Analyte List				Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1009GWMMW010-U	MMW010	Water		Primary	X	X				X	X		X	X	X	X	X	
1009GWMMW010-F	MMW010	Water	X	Primary			X			X	X		X	X	X	X	X	
1009GWMMW013-U	MMW013	Water		Primary	X	X				X	X		X	X	X	X	X	
1009GWMMW013-F	MMW013	Water	X	Primary			X			X	X		X	X	X	X	X	
1009GWMMW029-1-U	MMW029	Water		Primary	X	X				X	X		X	X	X	X	X	
1009GWMMW029-1-F	MMW029	Water	X	Primary			X			X	X		X	X	X	X	X	
1009GWMMW029-2-U	MMW029	Water		Duplicate	X	X				X	X		X	X	X	X	X	
1009GWMMW029-2-F	MMW029	Water	X	Duplicate			X			X	X		X	X	X	X	X	

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

Primary QC sample indicates that it is the first samples collected.

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2010 would have a prefix of (1006) followed by the normal sample ID.

Table 8
Spring 2010 Sample Tracker for Seeps, Springs, and Streams
(Page 1 of 2)

					Laboratory Parameters - Seeps, Springs, and Streams Analyte List							Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Se, Cd (SW6020A)	Total V (EPA6010B)	Dissolved Cd (EPA6020A)	Dissolved Cl, S04 (EPA 300.0)	Dissolved Ca, Mg (EPA 6010B)	Total Dissolved Solids (EPA 160.1)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1005GWMDS025-U	MDS025	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMDS025-F	MDS025	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMDS026-U	MDS026	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMDS026-F	MDS026	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMDS030-U	MDS030	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMDS030-F	MDS030	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMDS034-U	MDS034	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMDS034-F	MDS034	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMSG004-1-U	MSG004	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMSG004-1-F	MSG004	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMSG004-2-U	MSG004	Water		Duplicate	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMSG004-2-F	MSG004	Water	X	Duplicate			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMSG005-U	MSG005	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMSG005-F	MSG005	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMSG006-U	MSG006	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMSG006-F	MSG006	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMSG007-U	MSG007	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMSG007-F	MSG007	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMST069-U	MST069	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMST069-F	MST069	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMST096-U	MST096	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMST096-F	MST096	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMST136-U	MST136	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMST136-F	MST136	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X
1005GWMST144-U	MST144	Water		Primary	X	X				X		X	X	X	X	X	X	X	X	X	X
1005GWMST144-F	MST144	Water	X	Primary			X	X	X			X	X	X	X	X	X	X	X	X	X

Table 8
Spring 2010 Sample Tracker for Seeps, Springs, and Streams
(Page 2 of 2)

					Laboratory Parameters - Seeps, Springs, and Streams Analyte List							Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Se (SW6020A)	Total V (EPA6010B)	Dissolved Cd (EPA6020A)	Dissolved Cl, S04 (EPA 300.0)	Dissolved Ca, Mg (EPA 6010B)	Total Dissolved Solids (EPA 160.1)		Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1005ER-GW-01-U	na	Water		ER	X	X				X											
1005ER-GW-01-F	na	Water	X	ER			X	X	X												
1005ER-GW-02-U	na	Water		ER	X	X				X											
1005ER-GW-02-F	na	Water	X	ER			X	X	X												
1005ER-GW-03-U	na	Water		ER	X	X				X											
1005ER-GW-03-F	na	Water	X	ER			X	X	X												
1005ER-GW-04-U	na	Water		ER	X	X				X											
1005ER-GW-04-F	na	Water	X	ER			X	X	X												
1005B-GW-01-U	na	Water		B	X	X				X											
1005B-GW-01-F	na	Water	X	B			X	X	X												

ER - equipment rinsate blank sample, to be taken once per field team per day from non-dedicated sampling equipment, total ERs taken may not add up to what is accounted for here

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

Primary QC sample indicates that it is the first samples collected.

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2010 would have a prefix of (1006) followed by the normal sample ID.

Table 9
Fall 2010 Sample Tracker for Seeps, Springs, and Streams
(Page 1 of 1)

					Laboratory Parameters - Seeps, Springs, and Streams Analyte List						Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Se, Cd (SW6020A)	Total V (EPA6010B)	Dissolved Cd (EPA6020A)	Dissolved Cl, S04 (EPA 300.0)	Dissolved Ca, Mg (EPA 6010B)	Total Dissolved Solids (EPA 160.1)	Conductivity (µS/cm)	Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft^3/sec)
1009GWMDS025-U	MDS025	Water		Primary	X	X				X	X	X	X	X	X	X	X	X	X	X
1009GWMDS025-F	MDS025	Water	X	Primary			X	X	X		X	X	X	X	X	X	X	X	X	X
1009GWMDS026-U	MDS026	Water		Primary	X	X				X	X	X	X	X	X	X	X	X	X	X
1009GWMDS026-F	MDS026	Water	X	Primary			X	X	X		X	X	X	X	X	X	X	X	X	X
1009GWMDS030-1-U	MDS030	Water		Primary	X	X				X	X	X	X	X	X	X	X	X	X	X
1009GWMDS030-1-F	MDS030	Water	X	Primary			X	X	X		X	X	X	X	X	X	X	X	X	X
1009GWMDS030-2-U	MDS030	Water		Duplicate	X	X				X	X	X	X	X	X	X	X	X	X	X
1009GWMDS030-2-F	MDS030	Water	X	Duplicate			X	X	X		X	X	X	X	X	X	X	X	X	X
1009GWMDS034-U	MDS034	Water		Primary	X	X				X	X	X	X	X	X	X	X	X	X	X
1009GWMDS034-F	MDS034	Water	X	Primary			X	X	X		X	X	X	X	X	X	X	X	X	X
1009GWMSG004-U	MSG004	Water		Primary	X	X				X	X	X	X	X	X	X	X	X	X	X
1009GWMSG004-F	MSG004	Water	X	Primary			X	X	X		X	X	X	X	X	X	X	X	X	X
1009GWMST069-U	MST069	Water		Primary	X	X				X	X	X	X	X	X	X	X	X	X	X
1009GWMST069-F	MST069	Water	X	Primary			X	X	X		X	X	X	X	X	X	X	X	X	X
1009GWMST144-U	MST144	Water		Primary	X	X				X	X	X	X	X	X	X	X	X	X	X
1009GWMST144-F	MST144	Water	X	Primary			X	X	X		X	X	X	X	X	X	X	X	X	X
1009ER-GW-01-U	na	Water		ER	X	X				X										
1009ER-GW-01-F	na	Water	X	ER			X	X	X											
1009B-GW-01-U	na	Water		B	X	X				X										
1009B-GW-01-F	na	Water	X	B			X	X	X											

ER - equipment rinsate blank sample, to be taken once per field team per day from non-dedicated sampling equipment, total ERs taken may not add up to what is accounted for here

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

Primary QC sample indicates that it is the first samples collected.

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2010 would have a prefix of (1006) followed by the normal sample ID.

TABLE 10
SUMMARY OF ANALYTICAL RESULTS
SPRING AND FALL 2009 GROUNDWATER MONITORING
(Page 1 of 7)

Location Sample Date Sample Type		MBW006 05/10/2009 Primary	MBW009 05/10/2009 Primary	MBW011 05/10/2009 Primary	MBW026 05/11/2009 Primary	MBW027 05/11/2009 Primary	MBW028 05/11/2009 Primary	MBW032 05/12/2009 Primary	MBW048 05/12/2009 Primary	MBW085 05/13/2009 Primary	MBW087 05/09/2009 Primary
Dissolved Metals											
Aluminum	mg/L										
Cadmium	mg/L										
Calcium	mg/L	**178**	**174**	**108**	**78.1**	**92.2**	**218**	**364**	**18.7**	**58.4**	**87.5**
Chromium	mg/L										
Iron	mg/L	0.0250 U	**0.0305 J**	**0.0434 J**	**0.249**	0.0250 U	0.0250 U	0.0250 U	**0.159**	0.0250 U	0.0250 U
Magnesium	mg/L	**32.1**	**33.8**	**29.2**	**20.6**	**23.9**	**52.2**	**88.7**	**5.97**	**9.43**	**14.6**
Manganese	mg/L										
Nickel	mg/L										
Potassium	mg/L	**1.35**	**0.659 J**	**1.09**	**1.77**	**1.81**	**0.649 J**	**1.94**	**0.531 J**	**0.259 J**	**0.325 J**
Selenium	mg/L										
Sodium	mg/L	**14.3 J**	**17.7 J**	**17.0 J**	**45.1**	**31.2**	**16.7**	**11.9**	**5.51**	**5.35**	**5.83 J**
Vanadium	mg/L										
Zinc	mg/L										
Total Metals											
Aluminum	mg/L	0.0500 U	**0.0793 J**	0.0500 U	**14.4**	**0.283**	**0.114**	0.0500 U	**0.181**	0.0500 U	**0.358**
Antimony	mg/L										
Arsenic	mg/L										
Barium	mg/L										
Beryllium	mg/L										
Cadmium	mg/L	0.000125 U	**0.00106**	**0.000170 J**	**0.000893**	**0.000331 J**	**0.000490 J**	**0.000923**	0.000125 U	0.000125 UJ U	0.000125 U
Chromium	mg/L	**0.00130 J**	**0.000863 J**	**0.00141 J**	**0.0149**	**0.00231**	**0.00211**	**0.00303**	**0.000879 J**	**0.000747 J**	**0.00142 J**
Cobalt	mg/L										
Copper, total	mg/L										
Iron	mg/L	**0.0297 J**	**0.0927 J**	**0.0954 J**	**17.5**	**0.402**	**0.167**	**0.0786 J**	**0.278**	**0.276**	**0.338**
Lead	mg/L										
Manganese	mg/L	**0.0158**	**0.495**	**0.096**	**0.0691**	**0.00508**	**0.176**	**0.00883**	**0.278**	**0.00510 J**	**0.157**
Mercury	mg/L										
Molybdenum	mg/L										
Nickel	mg/L	**0.00606**	**0.0165**	**0.00629**	**0.0200**	**0.00595**	**0.0177**	**0.0119**	**0.00365 J**	**0.00265 J**	**0.00377 J**
Selenium	mg/L	**0.3**	**0.0117**	**0.569**	**0.221**	**0.21**	**0.894**	**0.605**	0.000500 U	**0.00131**	**0.000798 J**
Silver	mg/L										
Thallium	mg/L										
Uranium, total	mg/L										
Vanadium	mg/L	0.00500 U	0.00500 U	0.00500 U	**0.0303**	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U
Zinc	mg/L	**0.00781 J**	**0.00645 J**	**0.170**	**0.0625**	**0.00609 J+/B**	**0.00633 J+/B**	**0.0128 J+/B**	0.00500 U	**0.00695 J+/B**	**0.0244 J**
General Chemistry											
Chloride	mg/L	**4.62**	**4.90**	**12.5**	**4.31**	**4.51**	**10.5**	**5.40**	**4.19**	**5.48**	**16.2**
Hardness as CaCO3	mg/L	**577**	**574**	**389**	**280**	**329**	**760**	**1280**	**71.2**	**185**	**279**
Nitrate/Nitrite as N	mg/L	**0.977**	0.0250 U	**6.07 J-**	**2.08 J-**	**0.307 J+**	**1.96**	**0.516 J+**	**0.0870 J+**	**0.133**	**0.0350 J**
Residue, Filterable (TDS) @180	mg/L	**808**	**800**	**506**	**554**	**508**	**1090**	**1860**	**116**	**228**	**342**
Sulfate	mg/L	**375**	**334**	**163**	**157**	**182**	**474**	**867**	**6.68**	**33.4**	**27.4**
Suspended Solids	mg/L	2.50 U	2.50 U	2.50 U	**127**	**8.50**	**5.00 J**	2.50 U	**3.00 J**	2.50 U	2.50 U
Total Alkalinity	mg/L	**222 J+**	**258 J+**	**207 J+**	**217**	**216**	**251**	**333**	**65.3 J-**	**173**	**259 J+**
Radiological											
Gross Alpha	PCI/L	2.91 U	3.53 U	1.66 U	**8.12**	**5.55**	2.68 U	**12.4**	3.24 U	3.51 U	1.77 U
Gross Beta	PCI/L	4.82 U	4.48 U	3.13 U	4.69 U	3.61 U	2.82 U	**6.10**	4.24 U	3.08 U	2.58 U

TABLE 10
SUMMARY OF ANALYTICAL RESULTS
SPRING AND FALL 2009 GROUNDWATER MONITORING

Location / Sample Date / Sample Type		MBW099 05/12/2009 Primary	MBW107 06/04/2009 Primary	MBW130 05/15/2009 Primary	MBW131 05/15/2009 Primary	MBW135 05/15/2009 Primary	MBW152 05/16/2009 Primary	MMW004 06/01/2009 Primary	MMW006 06/03/2009 Primary	MMW007 06/01/2009 Primary	MMW008 06/01/2009 Primary
Dissolved Metals											
Aluminum	mg/L	0.0500 U	0.0500 U								
Cadmium	mg/L	0.000125 U	0.000125 U								
Calcium	mg/L	**27.8**	**32.0**								
Chromium	mg/L	**0.00117 J**	**0.00209**								
Iron	mg/L	**0.0693 J**	0.0250 U								
Magnesium	mg/L	**6.75**	**9.06**								
Manganese	mg/L	**0.0385**	**0.00517**								
Nickel	mg/L	**0.00212 J**	**0.00205 J**								
Potassium	mg/L	**0.579 J**	**2.25**								
Selenium	mg/L	0.000500 U	**0.00356**	**0.00223**	0.000500 U	0.000759 UJ U	**0.00536 J**				
Sodium	mg/L	**8.92**	**14.8**								
Vanadium	mg/L	0.00500 U	0.00500 U								
Zinc	mg/L	**0.217**	0.00500 U								
Total Metals											
Aluminum	mg/L										
Antimony	mg/L										
Arsenic	mg/L										
Barium	mg/L										
Beryllium	mg/L										
Cadmium	mg/L										
Chromium	mg/L										
Cobalt	mg/L										
Copper, total	mg/L										
Iron	mg/L										
Lead	mg/L										
Manganese	mg/L										
Mercury	mg/L										
Molybdenum	mg/L										
Nickel	mg/L										
Selenium	mg/L							**0.00273**	**0.0699**	**0.00119**	**0.000606 J**
Silver	mg/L										
Thallium	mg/L										
Uranium, total	mg/L										
Vanadium	mg/L										
Zinc	mg/L										
General Chemistry											
Chloride	mg/L	**9.18**	**3.49**								
Hardness as CaCO3	mg/L	**97.2**	**117**								
Nitrate/Nitrite as N	mg/L	**0.384 J+**	**1.16**								
Residue, Filterable (TDS) @180	mg/L	**128 J-**	**292 J-**					**548**	**402**	**196**	**176**
Sulfate	mg/L	**19.4**	**21.8**					**112**	**58.1**	**35.1**	**16.7**
Suspended Solids	mg/L	2.50 U									
Total Alkalinity	mg/L	**69.3 J-**	**133**								
Radiological											
Gross Alpha	PCI/L	**3.41**	1.97 U								
Gross Beta	PCI/L	**3.02**	3.00 U								

TABLE 10
SUMMARY OF ANALYTICAL RESULTS
SPRING AND FALL 2009 GROUNDWATER MONITORING
(Page 3 of 7)

Location Sample Date Sample Type			MMW009 06/04/2009 Primary	MMW010 06/04/2009 Primary	MMW010 09/23/2009 Primary	MMW011 06/02/2009 Primary	MMW013 06/03/2009 Averaged	MMW013 06/03/2009 Triplicate	MMW013 06/03/2009 Triplicate	MMW013 06/03/2009 Triplicate	MMW013 09/21/2009 Primary
Dissolved Metals											
	Aluminum	mg/L									
	Cadmium	mg/L									
	Calcium	mg/L	**76.8**								
	Chromium	mg/L									
	Iron	mg/L	**0.388**								
	Magnesium	mg/L	**28.2**								
	Manganese	mg/L									
	Nickel	mg/L									
	Potassium	mg/L	**0.570 J**								
	Selenium	mg/L									
	Sodium	mg/L	**5.97**								
	Vanadium	mg/L									
	Zinc	mg/L									
Total Metals											
	Aluminum	mg/L	**0.863**								
	Antimony	mg/L	0.000569 U								
	Arsenic	mg/L	**0.00153**								
	Barium	mg/L	**0.0563**								
	Beryllium	mg/L	0.000500 U								
	Cadmium	mg/L	**0.000571**								
	Chromium	mg/L	**0.00328**								
	Cobalt	mg/L	**0.000459 J**								
	Copper, total	mg/L	**0.00207**								
	Iron	mg/L	**1.1**								
	Lead	mg/L	**0.00218**								
	Manganese	mg/L	**0.112**								
	Mercury	mg/L	0.000100 U								
	Molybdenum	mg/L	**0.0222 J**								
	Nickel	mg/L	**0.0359**								
	Selenium	mg/L	0.000500 U	**0.0764**	**0.0191**	**0.00206**	**0.106**	**0.107**	**0.104**	**0.107**	**0.124**
	Silver	mg/L	0.000250 U								
	Thallium	mg/L	0.0000500 U								
	Uranium, total	mg/L	0.000790 U								
	Vanadium	mg/L	0.00500 U								
	Zinc	mg/L	**0.0430**								
General Chemistry											
	Chloride	mg/L	**4.72**								
	Hardness as CaCO3	mg/L	**308**								
	Nitrate/Nitrite as N	mg/L	**0.0860**								
	Residue, Filterable (TDS) @180	mg/L	**412**	**1770**	**1420**	**450**	**564**	**552**	**582**	**558**	**562**
	Sulfate	mg/L	**55.3**	**688**	**740**	**96.8**	**219**	**219**	**220**	**218**	**258**
	Suspended Solids	mg/L	**34.5**								
	Total Alkalinity	mg/L	**282**								
Radiological											
	Gross Alpha	PCI/L	2.33 U								
	Gross Beta	PCI/L	2.82 U								

TABLE 10
SUMMARY OF ANALYTICAL RESULTS
SPRING AND FALL 2009 GROUNDWATER MONITORING

Location		MMW014	MMW017	MMW018	MMW019	MMW020	MMW020	MMW021	MMW022	MMW023	MMW024
Sample Date		06/03/2009	06/03/2009	06/02/2009	06/02/2009	06/05/2009	09/23/2009	06/02/2009	06/02/2009	06/01/2009	05/19/2009
Sample Type		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Dissolved Metals											
Aluminum	mg/L										
Cadmium	mg/L										
Calcium	mg/L										**148**
Chromium	mg/L										
Iron	mg/L										0.0250 U
Magnesium	mg/L										**9.79**
Manganese	mg/L										
Nickel	mg/L										
Potassium	mg/L										**0.517 J**
Selenium	mg/L										
Sodium	mg/L										**5.05**
Vanadium	mg/L										
Zinc	mg/L										
Total Metals											
Aluminum	mg/L										0.0500 U
Antimony	mg/L										0.000250 U
Arsenic	mg/L										**0.000256 J**
Barium	mg/L										**0.0256**
Beryllium	mg/L										0.000500 U
Cadmium	mg/L										0.000125 U
Chromium	mg/L										**0.000657 J**
Cobalt	mg/L										0.000250 U
Copper, total	mg/L										**0.000971 J+/B**
Iron	mg/L										0.0250 U
Lead	mg/L										0.000250 U
Manganese	mg/L										**0.000688 J**
Mercury	mg/L										0.000100 U
Molybdenum	mg/L										0.00500 U
Nickel	mg/L										**0.00506**
Selenium	mg/L	**0.00173**	**0.0937**	**0.0276**	**0.00541**	**0.221**	**0.193**	**0.0488**	**0.0206**	**0.017**	**0.0243**
Silver	mg/L										0.000250 U
Thallium	mg/L										0.0000500 U
Uranium, total	mg/L										**0.000540 J**
Vanadium	mg/L										0.00500 U
Zinc	mg/L										0.00500 U
General Chemistry											
Chloride	mg/L										**3.91**
Hardness as CaCO3	mg/L										**411**
Nitrate/Nitrite as N	mg/L										**0.248**
Residue, Filterable (TDS) @180	mg/L	**350**	**1060**	**268**	**308**	**624**	**496**	**408**	**706**	**818**	**618**
Sulfate	mg/L	**28.6**	**447**	**42.9**	**55.9**	**183**	**197**	**46.1**	**246**	**227**	**246**
Suspended Solids	mg/L										2.50 U
Total Alkalinity	mg/L										**169**
Radiological											
Gross Alpha	PCI/L										2.92 U
Gross Beta	PCI/L										2.49 U

TABLE 10
SUMMARY OF ANALYTICAL RESULTS
SPRING AND FALL 2009 GROUNDWATER MONITORING

Location / Sample Date / Sample Type		MMW025 05/19/2009 Primary	MMW026 05/29/2009 Primary	MMW027 05/28/2009 Primary	MMW028 05/14/2009 Primary	MMW029 05/14/2009 Primary	MMW029 09/21/2009 Primary	MMW030 05/19/2009 Primary	MMW031 05/13/2009 Primary	MMW032 09/25/2009 Primary	MMW033 09/25/2009 Primary
Dissolved Metals											
Aluminum	mg/L										
Cadmium	mg/L										
Calcium	mg/L	21.9	36.2	135	54.7	222	226	29.6	33.2	51.9	44.4
Chromium	mg/L										
Iron	mg/L	0.0250 U	0.0513 J	0.0250 U	0.0250 U	0.0250 U	0.0250 U	0.0250 U	0.0250 U	0.0301 J	0.0250 U
Magnesium	mg/L	8.26	16.2	39.0	18.4	71.3	70.8	19.8	6.87	14.1	25.7
Manganese	mg/L										
Nickel	mg/L										
Potassium	mg/L	1.03	1.41	1.54	1.89	1.10	1.01	1.65	1.14	0.925 J	0.895 J
Selenium	mg/L										
Sodium	mg/L	25.5	28.7	6.85	26.3	10.9	9.95	21.6	7.15	22.8	22.0
Vanadium	mg/L										
Zinc	mg/L										
Total Metals											
Aluminum	mg/L	0.216	0.0500 U	0.0500 U	0.0500 U	0.0500 U	0.0500 U	0.426	0.0500 U	0.718	1.74
Antimony	mg/L	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.00100 U	0.00269	0.000250 U		
Arsenic	mg/L	0.000989 J	0.000266 J	0.00393	0.000250 U	0.00500 U	0.00125 U	0.0267	0.000456 J		
Barium	mg/L	0.0102	0.0216	0.0395	0.0436	0.0257	0.0249	0.0964	0.0355		
Beryllium	mg/L	0.000500 U	0.000500 U	0.000500 U	0.000500 U	0.000500 U	0.000500 U	0.000500 U	0.000500 U		
Cadmium	mg/L	0.000125 U	0.000125 U	0.000125 U	0.000125 U	0.000125 U	0.000125 U	0.000125 U	0.000125 U	0.000433 J	0.000125 U
Chromium	mg/L	0.00117 J	0.00154 J	0.00281	0.00114 J	0.00215	0.00312	0.00203	0.00290	0.0103	0.00524
Cobalt	mg/L	0.000250 U	0.000281 J	0.000250 U	0.000250 U	0.000273 J	0.000342 J	0.000436 J	0.000250 U		
Copper, total	mg/L	0.000716 J+/B	0.000500 U	0.000852 J	0.0231	0.00175 J+/B	0.00195 J	0.00169 J+/B	0.000500 U		
Iron	mg/L	0.155	0.0382 J	0.0250 U	0.0250 U	0.0250 U	0.0396 J+/B	0.353	0.0250 U	0.396	1.16
Lead	mg/L	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.00432	0.000250 U		
Manganese	mg/L	0.0209	0.0440	0.00115 J	0.000563 J	0.00223	0.00594	0.0923	0.000500 U	0.0491	0.344
Mercury	mg/L	0.000100 U	0.000100 U	0.000100 U	0.000100 U	0.000100 U	0.000100 U	0.000100 U	0.000100 U		
Molybdenum	mg/L	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U		
Nickel	mg/L	0.00115 J	0.00168 J	0.00538	0.00221 J	0.00727	0.00862	0.00254 J	0.00102 J	0.00407	0.00337 J
Selenium	mg/L	0.00168	0.00107 J	0.329 J	0.00551	0.685	0.865	0.00116	0.000683 J	0.00267	0.00577
Silver	mg/L	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.000250 U	0.000250 U		
Thallium	mg/L	0.0000500 U	0.0000500 U	0.0000500 U	0.0000500 U	0.0000500 U	0.0000500 U	0.0000538 J	0.0000500 U		
Uranium, total	mg/L	0.000889 J	0.00116	0.00155	0.00112	0.00344	0.00321	0.00171	0.000292 J		
Vanadium	mg/L	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.0165	0.00500 U	0.00500 U	0.0128	0.0130
Zinc	mg/L	0.00502 UJ/B U	0.00831 J	0.00500 U	1.56	0.00596 J+/B	0.00503 J	0.0133 UJ/B U	0.00500 U	0.0541	0.0425
General Chemistry											
Chloride	mg/L	4.09	4.89	13.0	34.2	7.64	6.88	13.2	7.29	4.01	5.22
Hardness as CaCO3	mg/L	88.6	157	497	212	849	857	155	111	188	217
Nitrate/Nitrite as N	mg/L	0.342	0.0250 U	1.37	0.762	0.264	0.214 J-	0.221	0.371	0.479	0.238
Residue, Filterable (TDS) @180	mg/L	204	414	2010	402	1170	1200	282	156	248	266
Sulfate	mg/L	13.9	19.7	227	70.7	556	582	16.4	6.10	9.96	30.9
Suspended Solids	mg/L	4.50 J	2.50 U	2.50 U	2.50 U	4.00 J	6.00	19.5	2.50 U	14.5	41.5
Total Alkalinity	mg/L	118	198	242	173	266	279	170	125	231	224
Radiological											
Gross Alpha	PCI/L	2.46 U	4.22	3.16 U	5.16 U	3.07 U	4.20 U	5.08	3.46 U	7.95	7.00 U
Gross Beta	PCI/L	2.29 U	3.20 U	3.81 U	3.12 U	4.65	2.38 U	3.84 U	3.53	3.98 U	4.83

Location		MMW034	MMW035	MMW035	MMW035	MMW035	MMW036	MW15A	MW16A
Sample Date		09/22/2009	09/22/2009	09/22/2009	09/22/2009	09/22/2009	09/22/2009	06/05/2009	06/04/2009
Sample Type		Primary	Averaged	Triplicate	Triplicate	Triplicate	Primary	Primary	Primary
Dissolved Metals									
Aluminum	mg/L								
Cadmium	mg/L								
Calcium	mg/L	**130**	**225**	**224**	**227**	**225**	**51.0**	**290**	**292**
Chromium	mg/L								
Iron	mg/L	**0.0258 J**	0.0250 U	0.0250 U	0.0250 U	0.0250 U	0.0250 U	0.0250 U	**0.573**
Magnesium	mg/L	**6.84**	**69.7**	**68.0**	**69.0**	**72.2**	**16.4**	**63.7**	**56.2**
Manganese	mg/L								
Nickel	mg/L								
Potassium	mg/L	**0.774 J**	**1.54**	**1.47**	**1.54**	**1.60**	**0.815 J**	**1.55**	**1.19**
Selenium	mg/L								
Sodium	mg/L	**5.05**	**9.75**	**9.44**	**9.70**	**10.1**	**15.9**	**26.7**	**22.3**
Vanadium	mg/L								
Zinc	mg/L								
Total Metals									
Aluminum	mg/L	**0.153**	0.0500 U	0.0500 U	0.0500 U	0.0500 U	**0.426**	**0.262**	0.0500 U
Antimony	mg/L							0.000527 U	0.000250 U
Arsenic	mg/L							0.0125 U	**0.00112**
Barium	mg/L							**0.0349**	**0.0397**
Beryllium	mg/L							0.000500 U	0.000500 U
Cadmium	mg/L	0.000125 U	0.000125 U	0.000125 U	0.000125 U	0.000125 U	0.000125 U	**0.000285 J**	0.000125 U
Chromium	mg/L	**0.00319**	**0.00405**	**0.00314**	**0.00463**	**0.00438**	**0.00357**	**0.00523**	0.000500 U
Cobalt	mg/L							**0.000954 J**	**0.000361 J**
Copper, total	mg/L							**0.00341**	**0.00159 J**
Iron	mg/L	**0.119**	**0.0291 J**	**0.0321 J**	**0.0262 J**	**0.0289 J**	**0.198**	**0.268**	**0.562**
Lead	mg/L							**0.000950 J**	0.000250 U
Manganese	mg/L	**0.00968**	**0.00797**	**0.00765**	**0.00842**	**0.00784**	**0.0124**	**0.0336**	**1.81**
Mercury	mg/L							0.000100 U	0.000100 U
Molybdenum	mg/L							0.00500 U	0.00500 U
Nickel	mg/L	**0.00516**	**0.00827**	**0.00717**	**0.00896**	**0.00868**	**0.00226 J**	**0.0127**	**0.0101**
Selenium	mg/L	**0.0762**	**0.772**	**0.772**	**0.762**	**0.781**	**0.00593**	**1.67**	**0.018**
Silver	mg/L							0.000250 U	0.000250 U
Thallium	mg/L							0.0000500 U	0.0000500 U
Uranium, total	mg/L							**0.00504**	**0.00492**
Vanadium	mg/L	**0.00987 J**	**0.0256**	**0.025**	**0.0258**	**0.0261**	**0.0109**	0.00500 U	0.00500 U
Zinc	mg/L	**0.00734 J**	**0.00517 J+/B**	0.00500 U	**0.00517 J+/B**	0.00500 U	0.00500 U	**0.00856 J**	**0.00538 J**
General Chemistry									
Chloride	mg/L	**8.91**	**17.5**	**17.5**	**17.4**	**17.6**	**7.42**	**6.71**	**12.8**
Hardness as CaCO3	mg/L	**353**	**850**	**840**	**852**	**859**	**195**	**986**	**960**
Nitrate/Nitrite as N	mg/L	**0.560**	**1.61**	**1.47**	**1.63**	**1.74**	**1.17**	**2.11**	**0.0280 J**
Residue, Filterable (TDS) @180	mg/L	**536**	**1140**	**1090**	**1220**	**1100**	**306**	**1580**	**1700**
Sulfate	mg/L	**209**	**447**	**446**	**447**	**447**	**25.4**	**650**	**748**
Suspended Solids	mg/L	**3.00 J**	2.50 U	2.50 U	2.50 U	2.50 U	**7.50**	**78.0**	2.50 U
Total Alkalinity	mg/L	**124**	**409**	**409**	**414**	**405**	**187**	**380**	**228**
Radiological									
Gross Alpha	PCI/L	3.50 U	**3**	1.96 U	2.80 U	**3.00**	**1.76**	**5.42**	5.21 U
Gross Beta	PCI/L	**6.63**	**3.12**	2.63 U	**3.12**	2.38 U	2.37 U	4.76 U	4.98 U

Notes:
BW - direct-push alluvial aquifer well
MW - monitoring well

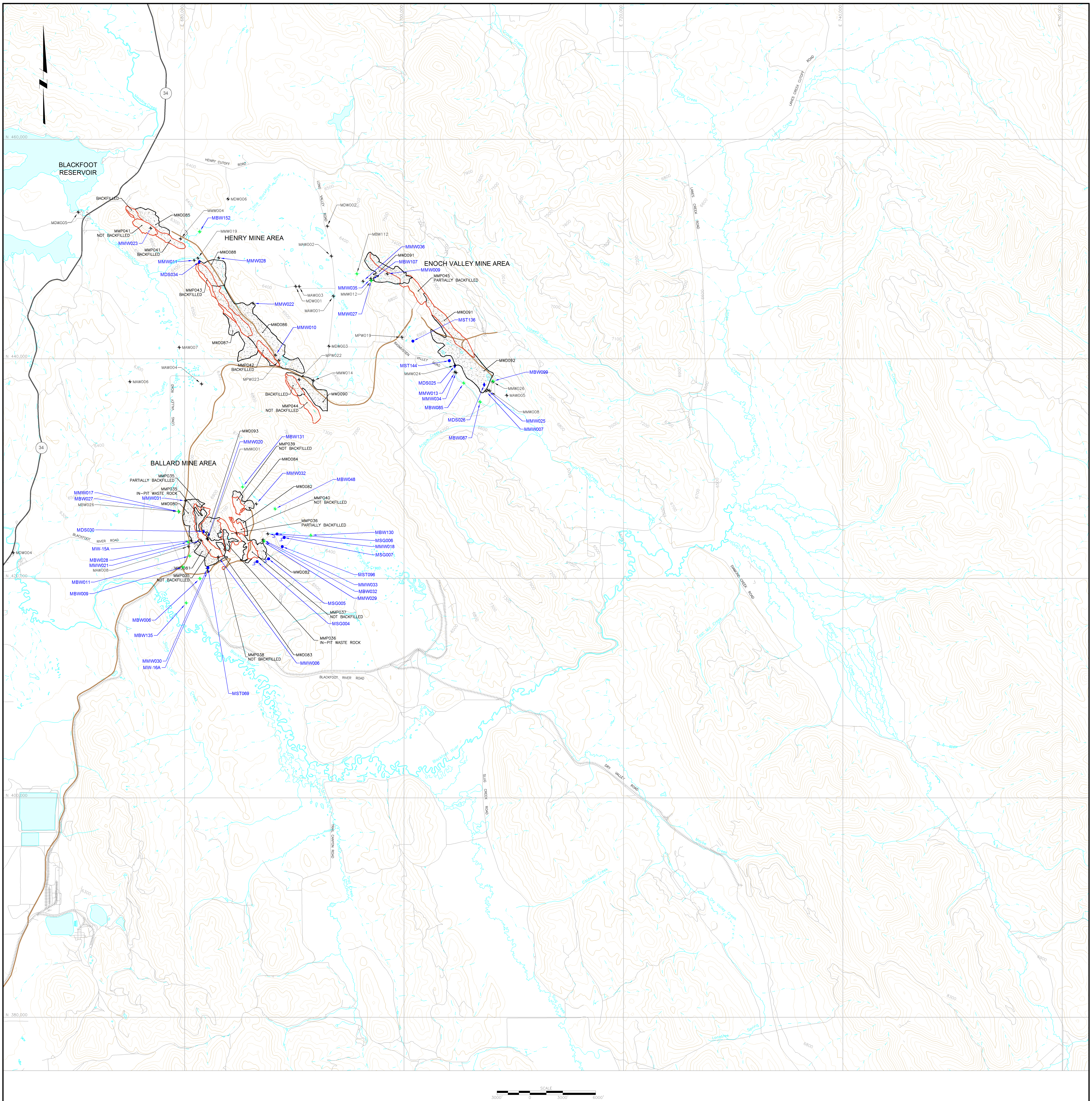
Flag Definition:

U	The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximated concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
J+/B	Result is estimated and biased high; associated field blank contained target analyte.
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

Triplicate Results:

The average value for triplicate samples is calculated as follows: (a) the mean of three detected values, (b) the mean of two detected values if result of one triplicate is not detected, (c) the detected value if results of two triplicates are not detected, or (d) less than the highest method detection limit if all triplicate results are not detected.

DRAWINGS



LEGEND:

- POST–MINE CONTOUR AND ELEVATION, FEET (APPROXIMATE)
- RIVER
- POND OR LAKE
- NATURAL DRAINAGE – PERENNIAL
- NATURAL DRAINAGE – INTERMITTENT
- HIGHWAY
- ROAD
- MONSANTO HAUL ROAD (ACTIVE & INACTIVE)
- RAILROAD
- MINE PIT LOCATION (APPROXIMATE WHERE COVERED BY BACKFILL)
- WASTE ROCK DUMP LOCATION (APPROXIMATE)
- WASTE ROCK DUMP LOCATION OR PIT BACKFILL (APPROXIMATE)

STATION TYPE:

- MMW = MONITORING WELL
- MAW = AGRICULTURAL WELL
- MDW = DOMESTIC WELL
- MPW = PRODUCTION WELL
- MBW = DIRECT PUSH WELL
- MMW = MONITORING WELL (PROPOSED 2010)
- MBW = DIRECT PUSH WELL (PROPOSED 2010)
- MDS = DUMP SEEP SAMPLE LOCATION (PROPOSED 2010)
- MST = STREAM SAMPLE LOCATION (PROPOSED 2010)
- MSG = SPRING SAMPLE LOCATION (PROPOSED 2010)

KEY:

MMP = MINE PIT
MWD = WASTE ROCK DUMP

WORKING DRAFT
INFORMATIONAL ONLY
5/12/10

REV	DESCRIPTION	TECH	ENG	DATE
A	DRAFT	CHF	LWM	04/05/10

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
1. POST–MINE TOPOGRAPHY GENERATED FROM:
   - USGS DIGITAL ELEVATION MODELS (DEM)–24K.
   - SURVEY DATA FOR BALLARD MINE PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: JUNE 2005.
   - SURVEY DATA FOR HENRY MINE AREA PROVIDED BY OLYMPUS AERIAL SURVEYS, INC. DATED: NOVEMBER 2008.
   - SURVEY DATA FOR ENOCH VALLEY MINE AREA PROVIDED BY P4 PRODUCTION DATED: DECEMBER 2007.
   - US CENSUS BUREAU 2007 TIGER LINE DATA

PROJECTION:
STATE PLANE COORDINATE SYSTEM
ZONE: IDAHO EAST
HORIZONTAL DATUM: NAD27
VERTICAL DATUM: NGVD29
UNITS: U.S. FEET

DESIGNED BY	L WOLF–MARTIN	04/05/10
DRAWN BY	C FOWLER	04/05/10
CHECKED BY	E MARKS	04/05/10
APPROVED BY	L WOLF–MARTIN	04/05/10
PROJECT MANAGER	C FOULK	04/05/10
CLIENT APPROVAL	B KOCH	04/05/10
CLIENT REFERENCE NO.		

P4 Production, LLC

PROJECT LOCATION: BALLARD, HENRY AND ENOCH VALLEY MINES
PROJECT: RI/FS WORK PLAN
TITLE: PROPOSED 2010 GROUNDWATER SAMPLE LOCATIONS

MWH

DRAWING: 1
REVISION: A
FILE NAME: 1007903D002

APPENDIX A

Response to A/T Comments on *Draft 2010 Groundwater Monitoring Memorandum, Revision 0*, prepared for P4 Production by MWH, April 2010.

General Comments

The referenced document describes the relevant components for the 2010 groundwater monitoring program at the P4 Production, L.L.C. (P4) mines near Soda Springs, Idaho. The referenced document, however, is not a “stand alone” work planning document. Instead, it is an abbreviated work plan that references applicable components, methods, and procedures included in P4’s *2009 Groundwater Monitoring Sampling and Analysis Plan* (*2009 Groundwater SAP;* MWH, 2009a), field sampling plan (FSP), quality assurance project plan (QAPP), and health and safety plan (HSP).

The A/T believes that abbreviated work plans with references other planning documents can be confusing and may result in sampling error and loss of valuable data. For this reason, the A/T generally prefers “stand alone” work planning documents. However, given the relatively narrow scope of the subject field effort (2010 groundwater monitoring), the A/T agrees that an abbreviated work plan is acceptable in this case. The A/T wishes to emphasize, however, that abbreviated work plans may not be acceptable in all cases and the approach should be discussed and agreed upon in advance.

Specific Comments

Page 2, Section 2.1. Please provide justification for not sampling monitoring wells (e.g., MMWOO4, -014, -019, -008, -012, -024, 026) identified in Table 1.

Response: *In general continued sampling of a monitoring well was not recommended if it was redundant (in the same flow path as another well), has been consistently dry, had a sufficiently long sampling record in location that was not impacted by the Sites, or would not be expected to vary during the period of the RI. The justification has been added to the memorandum text and is as follows:*

<u>*MMW004:*</u> *Monitoring well MMW004 is an old open borehole and steel cased well in the northern portion of the Henry Mine. It has been monitored since October 2004 during six sampling events. The selenium concentration has consistently been measured as being between 0.002 and 0.00273 mg/L, with one event having selenium not detected at 0.001 mg/L. Sulfate has also exhibited a narrow range of results over the six year period being between 112 and 137 mg/L. Concentrations over approximately 200 approximately mg/L sulfate are typical but not conclusive of groundwater impacted by waste rock dump seepage. The data from this monitoring well are adequate for the RI/FS, and it is reasonable to assume the concentration will not be significantly different in 2010. Therefore, sampling was not recommended.*

<u>*MMW014:*</u> *Monitoring well MMW014 at the Henry Mine has been sampled during four monitoring events. The total selenium concentration has ranged from not detected at*

0.001 mg/L to 0.00203 mg/L. The maximum sulfate concentration has been 61.9 mg/L. MMW014 is located very close to the toe of waste rock dump MWD090. Given the age of the waste rock dump, if there is an impact from the dump, it would have been observed in MMW014. Sufficient data have been collected from MMW014 for the RI/FS, and further sampling was not recommended.

<u>MMW019:</u> MMW019 at the Henry Mine is installed in shallow Phosphoria Formation. The maximum total selenium concentration from four sampling events has been 0.00541 mg/L and the maximum sulfate concentration 159 mg/L. Having been installed in the shallow Phosphoria Formation, which is not a key unit being characterized and not apparently impacted by the Henry Mine, further sampling is not recommended.

<u>MMW008:</u> Monitoring wells MMW007 and MMW008 are in the same hydrostratigraphic unit at the southern end of the Enoch Valley Mine (the upper weathered Dinwoody Formation/alluvial system). Neither monitoring well has produced groundwater samples suggestive of groundwater impacts from the mine. The maximum total selenium concentration measured in MMW008 was 0.00138 mg/L (four sampling events). Concentrations in MMW007 have been slightly higher with a maximum of 0.005 mg/L. With MMW007 in the same flow path and closer to the mine waste dump (the potential source), sampling of monitoring MMW008 is not necessary. It would become necessary if an impact in MMW007 was indicated.

<u>MMW012:</u> MMW012 is located at the Enoch Valley Mine and has never had sufficient water in it for sampling. Given the low snow pack and runoff in 2010, there is no reason to believe that it will have groundwater in it this year either. However, the water level in the monitoring well will be checked.

<u>MMW024:</u> Monitoring wells MMW024 and MMW034 are in the same flow path at the Enoch Valley Mine. Both are Dinwoody Formation monitoring wells downgradient of waste rock dump MWD092. MMW034 is further downgradient from MMW024, which was installed adjacent to MWD092. Both monitoring wells have indicator parameters suggestive of impacts from the mine site. Selenium in MMW024 has been measured at 0.0137 and 0.0243 mg/L in May 2008 and September 2009, respectively. Measured selenium concentrations in the more downgradient MMW034 are actually a little higher at 0.0762 mg/L (September 2009). It is appear that the impact to the groundwater has extended well beyond MMW024. Sampling both of these closely placed monitoring wells in the same flow path during every event is not necessary, and MMW034 is further downgradient and has only been sampled once. Therefore, MMW024 has been dropped from the 2010 sampling.

<u>MMW026:</u> This monitoring well at the Enoch Valley Mine has been sample twice, once in September 2008 and then in May 2009. The concentrations of analytes that may suggest an impact from the Enoch Valley Mine were low and relatively invariant between the two events. For example, sulfate which is almost always elevated in mine-impacted groundwater was reported as 19.5 and 19.7 mg/L in May 2008 and September 2009, respectively. Total selenium measured in MMW026 was 0.0013 and 0.00107 mg/L in

May 2008 and September 2009, respectively. Cadmium was not detected in either monitoring event. This monitoring well is key location for long-term monitoring of the Wells Formation and the Enoch Valley mine and will need to be sampled periodically. However, given the low concentrations and relatively consistent concentrations of the key indicator parameters, sampling in 2010 for the RI/FS appears unnecessary. Sampling in 2011 is suggested and that the monitoring well be included in a long-term monitoring program. However, the sampling frequency could be every other year so long as indicator parameters do not indicate an increasing trend.

Page 3, Section 2.2. Please provide justification for not sampling direct push borehole wells (e.g., MBWO2Ô, -112) identified in Table 1.

Response: *The MBW direct-push monitoring wells have proved to be time consuming to sample because of the limited ability to develop these small diameter wells. Therefore, where the location is redundant with another, and the well is positioned such that the data are not important to the RI, it has been suggested that sampling be discontinued. Additionally, if the well has been consistently dry, it has been dropped from the list. The following explanations will be added to the memorandum text:*

MBW026 (not MBW020): *This direct-push monitoring well at the Ballard Mine appears to be providing data redundant with co-located MBW027. The May 2009 selenium concentrations from MBW026 and MBW027 were 0.221 and 0.210 mg/L respectively. Water levels in these were approximately 1.3 feet different. Despite being installed at slightly different depths, the two monitoring wells appear to be monitoring the same hydrostratigraphic horizon and the same water quality. Further sampling of MBW026 was not recommended. It should be noted that this location also includes a deeper co-located conventional monitoring well, MMW017, which does appear to be monitor a separate portion of the alluvial system and has a slightly different water quality.*

MBW112: *This direct-push monitoring well has consistently been dry or not produced sufficient water to be sampled. The water level will be checked in 2010. In all likelihood this location should be abandoned.*

Page 4, Section 3.0, paragraph 2, sentences 1 & 2. It is noted that dissolved concentrations are not directly comparable to screening benchmarks for groundwater and that P4/Monsanto plans to collect and analyze unfiltered samples unless the samples are turbid. Since the direct push borehole wells cannot be easily and effectively developed, the A/T agreed that samples from these direct push borehole wells could be filtered. P4/Monsanto may wish to collect replicate samples for total and dissolved analyses to evaluate the turbidity issue where the samples "appear" to be non-turbid and to filter where the samples are obviously turbid upon sample collection if this course of action is pursued.

Response: *In direct-push boreholes, where samples "appear" to be non-turbid (<5 NTU), P4 will collect replicate samples for both total and dissolved metal analyses. However, if there is not enough water in the well, samples will be collected for total* *analyses only. In direct-push boreholes where turbidity is factor (>5 NTU), then samples will be collected for dissolved analyses (filtered) only. This clarification will be included in the text of Section 3.0.*

Page 4 Section 3.0, paragraph 4, sentence 3 (last). Please provide a list of "physical" water quality parameters such as "... P4 will also take physical water quality parameters (i.e., temperature, pH, etc.)."

Response: *The text has been revised to indicate that the following field parameters will be collected: pH; specific conductivity; dissolved oxygen; oxidation/reduction potential; turbidity; and temperature. These parameters are also indicated on the sample tracker table (Tables 4 through 9).*

Page 5, Section 3.1. The 4th sentence, starting with "The expanded list as . . ." appears to be incomplete (i.e., is missing a verb). Please revise accordingly.

Response: *It appears that "as" should have been "was". The text has been revised to read "The expanded analyte list* <u>*was*</u> *presented in Table B-3…….*

Page 5, Section 3.2. The 1st sentence indicates the 2008 & older monitoring wells were sampled for the expanded and regular lists in the past. The 2nd sentence notes that the 2008 and direct push wells were sampled in 2009 for the regular list, but there is not a corresponding statement for when any of the subject wells were sampled for the expanded list. For clarity, add text noting when the 2008 & older monitoring wells were sampled for the expanded list.
Reference is made to 2009 sampling results. These data have only been provided for the Data Quality and Usability Report upon request. Please provide a table with the results to which the narrative refers.

Response: *The text in this first paragraph has been revised to clarify when individual well groups have been sampled for which analyte list. A table of 2009 groundwater data has been added.*

Page 5, Section 3.2, paragraph 2, sentence 6. There has been one exceedance of the lead groundwater standard in MMWOO9. There is a concern if an exceedance has already been documented after only two years (2007 and 2008) of sampling this Wells Fm well. Any COPC that is above the detection limit, except possibly those contaminants with naturally high background levels (e.g., aluminum, iron, manganese), should continue to be sampled at this well.

Response: *MMW009 has been sampled three times – Fall 2007, Spring 2008 and Spring 2009. Both dissolved and total lead was analyzed during the 2007 and 2008 events. The sample in question was collected during the Spring 2008 event and was a triplicate sample. Two of the splits had elevated concentrations of 0.0286 and 0.0230 mg/L. The third split had a concentration of 0.0007 mg/L. The triplicate results for the dissolved fraction were all not detected at 0.0005 mg/L. The total lead results for the other two* *events were 0.0001 and 0.00218 mg/L. The source of the elevated total lead concentrations has never been resolved; therefore, total lead will be collected from MMW009 during the 2010 sampling event. However, another low result similar to the Fall 2007 and Spring 2009 event should be sufficient to indicate that total lead is not an issue and could be dropped from the analyte list for future events. The only other constituents that exceeded the screening levels were aluminum, iron, and manganese. As a result of naturally high background levels, we agree with the A/T that we do not feel that continuing to sample for these parameters is warranted.*

Page 6, Section 3.3. We acknowledge that new wells installed in 2010 will not be sampled for the expanded list in 2010. However, the text should include a note that these new wells may need to be sampled for the expanded list during a future sampling event (as may be specified in a forthcoming RI/FS work plan or other applicable planning document). Please revise the text to include a note to this effect.

Response: *The following has been added to the Section: "These wells may be sampled for the expanded list in future sampling events as indicated in future planning documents."*

Page 6, Section 3.5. To assist the reader in being able to differentiate between the analyte lists for seeps, springs, and streams versus the analyte lists for MST144 and MST069 (which will include both groundwater and surface water analytes), please reference the appropriate tables and/or provide a description of the complete analyte list for MST144 and MST069, as applicable.

Response: *The statement was in error. It is actually MST136 that will be sampled under both programs, not MST144. Text has been added to indicate that in addition to the groundwater analytes, stations MST069 and MST136 will be sampled for the following per the 2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan (MWH, 2009b):*

- *Dissolved iron, potassium, sodium, vanadium, and zinc*
- *Alkalinity*
- *Hardness*

Page 7 (Section 4.0), "filled" bullet 2. These sites should have been sampled in 2009. Further sampling would be dependent on the 2009 results such that low fall concentrations of selenium might mean that there would be no need to continue to sample these sites in the fall. Please provide the 2009 data and justification as to why these sites should continue to be sampled in the fall.

Response: *We agree that fall 2009 data will be taken into consideration when determining what locations will be included during the fall 2010 event. As stated in Section 4.0, page 11,"It is also noted that if the pending spring 2010 data is significantly lower than the fall 2009 data for wells installed in 2009, then additional wells (e.g.,* *MMW034 and MMW035) will be included." The fall 2009 data have been provided in new table (Table 10).*

Table 1. For MBW112 there are 3 asterisks in column Spring 2010 but no explanation in the footnotes. Please explain.

Response: *This was to indicate that the water level would be monitored. This note has been added to all the monitoring wells where sampling is not planned in 2010*.

Tables 4-9. To assist the reader, it would be helpful to correlate the "Laboratory Parameters" columns of Tables 4-9 with the type of analyte list that is applicable to each table. For example, Table 4 is the expanded analyte list for monitoring wells installed in 2009, but the term "expanded list" is not explicitly shown or stated on Table 4. We recommend that a footnote or other appropriate reference be added to "Laboratory Parameters" columns of Tables 4-9 specifying which analyte list the "Laboratory Parameters" are referencing.
Additionally, the "QC Sample Type" column in Tables 4-9 refers to a "Primary" QC Sample Type. To alleviate potential confusion in using the term "Primary" for both a type of QC sample and as a list of analytes, please add a footnote to each table defining the meaning of the term "Primary" when used as a QC Sample Type.

Response: *The table has been revised as requested*.

Drawing I. Drawing 1 is actually identified as Drawing 2. Please rectify.

Response: *The correction has been made.*

Editorial comments

Page 8 (Section 4.4), paragraph 7 (last), line 5. Change decrease to "decreases."
Page 11 (Section 5.2), paragraph 3, line 4. Delete the first evaluated.
Page 21 (Section 7.0), paragraph I, line 2. Change atto "as."
No page number (Table 1), Henry Mine, row 1, column 1. Correct spelling of Henry.

Response: *It appears that this comment was inadvertently added. The editorial locations indicated are not associated with the 2010 Groundwater Monitoring Memorandum.*

ATTACHMENT 4
2012 SURFACE WATER AND GROUNDWATER MEMORANDUM

MWH

BUILDING A BETTER WORLD

May 7, 2012

Mr. Dave Tomten
U.S. Environmental Protection Agency
1435 N. Orchard Street
Boise, ID 83706

RE: Transmittal of Proposed 2012 Surface and Groundwater Monitoring Programs - Final Rev2

Dear Dave:

This letter presents the proposed 2012 surface water and groundwater monitoring program at the P4 Production, L.L.C. (P4) mines near Soda Springs, Idaho. The mines include the inactive properties of Ballard, Henry, and Enoch Valley mines, collectively referred to as the Sites. The sampling program presented in this letter was specifically requested by the Agencies and Tribes (A/T) in an conference call held on April 9, 2012. The work is being performed in accordance with the requirements of the Administrative Settlement Agreement and Order on Consent/Consent Order for Remedial Investigation/Feasibility Study (2009 CO/AOC; USEPA, 2009). The proposed 2012 surface water and groundwater monitoring objectives and program are further outlined below.

2012 Surface Water Monitoring Program

The objective of previous surface water monitoring conducted at the sites (2004-2008) was to support characterization of the nature and extent of impacts to water quality associated with releases to surface water from potential sources at the Sites. In 2009, the surface water monitoring program transitioned from characterization to an interim monitoring plan that provided an annual assessment of surface water conditions downstream of potential sources associated with the Sites. This longer term data allows for a more effective evaluation of individual mine site remedies in the future and a greater understanding of potential long-term trends. The details of this plan, including data quality objectives (DQOs) and the field sampling plan (FSP), are included in the attached A/T-approved *Final Revision 2 - 2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan* (*2009/2010 Surface Water SAP*; MWH, 2009).

As the objectives of the 2012 monitoring are the same as the 2009/2010 monitoring program, the 2012 surface water monitoring will mimic the 2009/2010 program with the following differences:

- Headwater streams, seeps, and springs (Surface Expressions of Groundwater [SEGW]) will be included in the 2012 surface water monitoring program. Sample locations characterized as SEGW locations were originally included in the A/T-approved *Final Revisions 2 - 2010 Groundwater Sampling and Analysis Plan (2010 Groundwater SAP*; MWH, 2010). Because the sampling methodologies for the SEGW locations are very similar to the surface water locations, all SEGW locations from the *2010 Groundwater SAP* have been included in the list of surface water stations.

- For the SEGW stations, the primary difference in the analytes between the 2010 groundwater monitoring program and the 2012 surface water monitoring program is in the total and dissolved analyses. For the groundwater program, the total fraction for cadmium and vanadium was analyzed, and for the surface water program the dissolved fraction was analyzed. These SEGW stations will be compared to surface water screening criteria, which are based on the dissolved fraction. Therefore, analyses for cadmium and vanadium will now be for the dissolved fraction.

- Dissolved iron and chloride have been removed from 2012 list of surface water analytes because sufficient data for these analytes now exists to support geochemical characterization of water types.

- Select stations that are currently proposed as background stations (MST048, MST0226, MST274, and MST275) will be included in the 2012 surface water monitoring program. The data from these stations may be incorporated into background statistics at a future date, presumably during the risk assessment phase of the project where recalculation of select background statistics would benefit decisions for a specific media/exposure scenario.

The key elements of the 2012 surface water monitoring program are summarized on Table 1 - *Surface Water and Groundwater Analyte List* and Table 2 - *Surface Water Monitoring Locations, Frequency and Schedule*. The sample collection and analysis will be performed according to the methods and procedures outlined in the *2009/2010 Surface Water SAP and FSP* included as Attachment 1 to this letter.

As shown on Table 2, a subset of the surface water monitoring locations will be re-evaluated after the spring 2012 sampling event to determine whether they will be sampled in the fall. As in the *2009/2010 Surface Water SAP*, those sites with consistently higher selenium and sulfate concentrations in the fall as compared to spring will be retained for sampling. The fall sampling decision will use both the spring 2012 and historical data to determine which stations, if any, need to be re-sampled in fall 2012.

2012 Groundwater Monitoring Program

P4 believes that the objectives of groundwater monitoring that occurred in 2010 are essentially the same as the proposed 2012 sampling program. Characterization of groundwater at the Sites has been conducted in a phased approach since 2004. Ongoing monitoring of contaminants of potential concern (COPC) concentrations and piezometric conditions in monitoring wells is needed to complete characterization of the nature and extent of COPCs in groundwater. The groundwater data collected under the *2010 Groundwater SAP* and this 2012 plan will continue to support the RI/FS evaluation and refinement of the hydrogeologic conceptual models of the Sites. However, it is noted that the groundwater monitoring plan will need to be revisited in the future to transition from characterization to a long-term monitoring plan.

Changes proposed between the 2010 groundwater monitoring program and the 2012 groundwater sampling program are outlined below.

- SEGW (i.e., headwater streams, seeps, and springs) have been moved in 2012 from the groundwater program to the 2012 Surface Water Monitoring Program as discussed above.

- In 2010, groundwater collected from wells was analyzed following a primary, regular, or expanded list of analytes (see Table 2 of the *2010 Groundwater SAP*). With the exception of MMW037, installed in 2010, groundwater monitoring wells (2009 and older) and direct-borehole wells will be sampled for the primary analyte list in spring 2012, as they have been sampled and analyzed at least once for the expanded and regular list of analytes (see Sections 3.1 and 3.2 of the *2010 Groundwater SAP*). In addition in 2012, total manganese will be added to the primary list. This addition to the primary list will be re-evaluated based on the 2012 sampling results to determine if it is warranted in future sampling rounds. MMW037 will be sampled for the expanded list in spring 2012 and, based on analytical results, will be sampled for the primary list during subsequent sampling events.

- MMW024 and MMW026 at the Enoch Valley Mine have been added back to the list of monitor wells sampled as part of the *2010 Groundwater SAP*. MMW026 is currently proposed as a background well location and MMW024 is needed to monitor concentrations in the Dinwoody Formation.

- Agricultural, domestic, and production wells that have been proposed as background wells will be sampled once in 2012. These wells will be sampled for the regular analyte list. Given the complexities associated with accessing the private wells, sampling of these stations will occur later in 2012, as deemed practical. The P4 production well MPW019, will be sampled in spring 2012 because access to this well is not an issue.

- No fall groundwater sampling is proposed. Review of 2010 and historical selenium and sulfate data for the three wells sampled in the fall of 2010, MMW010, MMW013, and MMW029, does not support additional fall sampling events.

The key elements of the 2012 groundwater monitoring program are summarized on Table 1, *Surface Water and Groundwater Analyte List* and Table 3, *Groundwater Locations, Frequency and Schedule*. The sample collection and analysis will be performed according to the methods and procedures outlined within the *2009 Groundwater Monitoring SAP and FSP* (MWH, 2009) and the *2010 Groundwater Monitoring SAP and FSP* included as Attachments 2 and 3 to this letter. As shown on Table 3 on this letter, sampling of MMW012 and MBW112 is still contingent on water occurring in these wells. If groundwater is present in either of these wells, and the wells recover following purging, then the wells will be sampled in consultation with the A/Ts.

We appreciate your timely review of the proposed sampling program. P4 anticipates sampling to begin on May 7, 2012. If you have any questions or comments on this proposed sampling event, please do not hesitate to contact Rachel Roskelley at (208) 547-1248, or me at (801) 617-3250.

Best Regards,

Vance Drain, P.G.
Project Manager

Distribution:
Dave Tomten, USEPA
Tim Mosko, CH2M Hill
Michael Rowe, IDEQ
Gerry Winter, IDEQ
Mary Kauffman, USDA-FS
Caribou National Forest, Soda Springs District Office
James Alexander, USDA
Kelly Wright, Shoshone-Bannock Tribes
Sandi Fisher, USFWS
Susan Hanson, Shoshone-Bannock Tribes
Colleen O'Hara, BLM
Celeste Christensen, MWH
Bruce Narloch, MWH
MWH Project File
Joe Wallace, USEPA
Lorraine Edmond, USEPA
Marcy Pearhill, IDEQ
Sherri Clark, FS
Eldine Stevens, BIA
Gary Billman, IDL
Carolann Cole, North Wind Inc.
Mike Vice, Monsanto
Randy Vranes, Monsanto/P4
Rachel Roskelley, Monsanto/P4
Randy White, Monsanto
Dale Ralston, RHS
Cary Foulk, MWH
Vance Drain, MWH

TABLES

TABLE 1
SURFACE WATER AND GROUNDWATER
ANALYTE LIST

Category	Fraction	Analytes (Analytical Method)
Surface Water		
Streams , Seeps, and Springs,	Unfiltered Filtered Filtered Filtered Filtered Unfiltered	Se (EPA 6020A) Cd (EPA 6020A) V (EPA 6010B) Ca, Mg (EPA 6010B)[a] SO_4 (EPA 300.0) TDS (EPA 160.1)
Groundwater		
2009 and Older Monitor Wells and Direct Push Borehole Wells	 Unfiltered[b] Filtered Unfiltered	*<u>Primary Analyte List</u>* Cd, Mn, Se (EPA 6020A) SO_4 (EPA 300.0) TDS (EPA 160.1)
Agricultural, Domestic and Production Wells	 Unfiltered Unfiltered Unfiltered Unfiltered Unfiltered Filtered Filtered Filtered Filtered Filtered	<u>Regular Analyte List</u> TDS (EPA 160.1) TSS (EPA 160.2) Al, Fe, V (EPA 6010B) Cd, Cr, Mn, Ni, Se, Zn (EPA 6020A) Gross alpha, gross beta (EPA 900) Nitrogen - total nitrate-nitrite (EPA 353.2) SO_4, Cl (EPA 300.0) Ca, Fe, Mg, K, Na (EPA 6010B) Alkalinity (EPA 310.2) Hardness (SM2340B)
2010 Monitor Wells[c]	 Unfiltered Unfiltered Unfiltered Unfiltered Filtered Filtered Filtered Filtered Filtered Unfiltered Unfiltered	*<u>Expanded Analyte List</u>* Al, Ba, Be, Fe, Mo, V (EPA 6010B) Sb, As, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, Tl, U, Zn (EPA 6020A) Hg (EPA 7471) Gross alpha, gross beta (EPA 900) Nitrogen - total nitrate-nitrite (EPA 353.2) SO_4, Cl (EPA 300.0) Ca, Fe, Mg, K, Na (EPA 6010B) Alkalinity (EPA 310.2) Hardness (SM2340B) TDS (EPA 160.1) TSS (EPA 160.2)

Notes:
[a]Hardness is calculated on filtered fractions of Ca and Mg
[b]Direct-push monitoring wells may be sampled for dissolved or dissolved and total fractions depending on turbidity (see *2010 Groundwater SAP*).
[c]The only 2010 well is MMW037, it will be sampled for the expanded list once in 2012 and subsequently will be sampled for the primary list based on the spring 2012 analytical results.

TABLE 2
SURFACE WATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE

Mine	Station ID[a]	Feature Name[b]	Location[c]			
			Latitude	Longitude	Spring	Fall[d]
Ballard Mine	MST019	Blackfoot River below Ballard Creek	42 48 49.28	111 30 21.52	X	TBD
	MST020	Blackfoot River below State Land Creek	42 48 31.97	111 30 06.28	X	TBD
	MST050	*Long Valley Creek* below Ballard Mine	42 50 54.00	111 29 49.00	X	
	MST066	*Ballard Creek* above Blackfoot River	42 48 56.30	111 30 07.32	X	
	MST067	*Ballard Creek* headwaters	42 49 23.79	111 29 36.31	X	
	MST069[e]	*Short Creek* below Ballard Mine	42 49 11.23	111 29 19.75	X	TBD
	MST089	*Wooley Valley Creek*, below *North Fork Wooley Valley Creek*	42 49 28.70	111 26 19.40	X	
	MST090	*Wooley Valley Creek*, above *North Fork Wooley Valley Creek*	42 49 28.00	111 26 49.00	X	
	MST092	*North Fork Wooley Valley Creek* above *Wooley Valley Creek*	42 49 40.00	111 27 04.30	X	
	MST094	*Spring-fed trib. #1 of N. Fork Wooley Valley Cr.,* below Ballard Mine	42 49 56.00	111 28 10.00	X	
	MST095	*Spring-fed trib. #2 of N. Fork Wooley Valley Cr.,* below Ballard Mine	42 49 39.00	111 28 05.00	X	
	MST096[f]	Tributary of North Fork Wooley Valley Creek, below Ballard Mine	42 49 30.00	111 27 45.00	X	
	MDS030[f]	*Pit #2 Upper Dump Seep*	42 49 44.25	111 29 20.95	X	TBD
	MSG004[f]	*Holmgren Spring*	42 49 16.75	111 28 16.04	X	TBD
	MSG005[f]	*Cattle Spring*	42 49 19.07	111 28 01.90	X	
	MSG006[f]	*Southeast Spring*	42 49 41.43	111 27 51.34	X	
	MSG007[f]	*South of Southeast Spring*	42 49 38.19	111 27 42.68	X	
Henry Mine	MST044	Immediately below Henry Mine (1997 #24)	42 53 50.60	111 29 24.80	X	TBD
	MST045	Little Blackfoot River above Henry Creek	42 54 10.70	111 29 30.10	X	TBD
	MST051	East Fork Long Valley Creek below Henry Mine	42 52 18.23	111 28 58.49	X	
	MST057	West Fork Lone Pine Creek above Lone Pine Creek	42 51 59.49	111 26 21.78	X	
	MST063	Strip Mine Creek below Henry Mine	42 52 01.70	111 27 03.40	X	
	MDS034[f]	Henry Mine, Dump Seep #3	111 29 23.87	42 53 46.90	X	TBD
Enoch Valley Mine	MST128	*Angus Creek* above Rasmussen Creek	42 51 08.00	111 22 32.00	X	
	MST131	*Rasmussen Creek* above Angus Creek	42 51 08.00	111 22 31.00	X	
	MST132	Angus Creek Above *No Name Creek* and below *Rasmussen Creek*	42 51 07.00	111 22 29.00	X	
	MST133	*Rasmussen Creek* below Enoch Valley Mine	42 51 48.00	111 23 50.00	X	
	MST136[e]	*Rasmussen Creek* headwaters near *Enoch Valley Mine Shop Pond*	42 52 34.00	111 25 03.00	X	
	MST143	*East Fork Rasmussen Creek* above *Rasmussen Creek*	42 51 31.70	111 23 01.40	X	

TABLE 2
SURFACE WATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE

Mine	Station ID[a]	Feature Name[b]	Location[c]			
			Latitude	Longitude	Spring	Fall[d]
	MST144[f]	*West Pond Creek headwaters*, below West Pond	42 52 16.07	111 24 18.66	X	TBD
	MST269	*East Fork Rasmussen Creek* headwaters	42 52 16.57	111 23 41.69	X	
	MDS025[e]	West Dump Seep	42 52 13.00	111 24 11.00	X	TBD
	MDS026[f]	South Dump Seep	42 51 54.20	111 23 36.27	X	TBD
Select Background Stations	MST048	Little Blackfoot River	42 55 12.99	111 26 26.78	X	
	MST093	*North Fork Wooley Valley Creek* above Ballard Mine	42 50 28.00	111 28 34.00	X	
	MST226	Tributary to Lone Pine Creek	42 51 42.27	111 25 55.16	X	
	MST274	West Fork of Rasmussen Creek	42 51 31.00	111 23 34.00	X	TBD
	MST275	Tributary to Lone Pine Creek	42 51 56.33	111 25 04.24	X	TBD

MDS - Dump Seep
MSG - Spring
MST – Stream
TBD - To be determined

[a]Table does not include all available surface water monitoring stations at the P4 Sites, only those sites identified in the *2009 and 2010 Surface Water SAP*, as well as Surface Expressions of Groundwater (SEGW) sites from the *2010 Groundwater SAP*.
[b] Stream names in *italics* were assigned by either IMA or P4 Production as these streams are unnamed on USGS maps or, as far as is known, are unnamed by common usage of local inhabitants. The reason for this is that most such streams are small with intermittent or ephemeral flows.
[c]Location (GPS) coordinates use the NAD27 datum and are presented in ddd mm ss.ss format (degrees minutes seconds).
[d]Fall sampling program will be evaluated based on 2012 and historical results and will follow the protocol set forth in the 2009 and 2010 Surface Water SAP.
[e]Included as a sampling station in the *2009 and 2010 Surface Water SAP* as well as the *2010 Groundwater SAP*.
[f] Included as a sampling station in the *2010 Groundwater SAP*.

TABLE 3 GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE								
Mine	**Station ID**	**Station Description**	**Location**		**Well Install Year**	**Groundwater System Monitored Screened Interval (ft bgs)**	**Spring/ Fall**	**Analyte List**
			Latitude	**Longitude**				
Ballard Mine	MBW006	Short Creek	42 49 04.15	111 29 25.80	2008	Alluvial 14-9	Spring	Primary
	MBW009	Blackfoot River Road @ Monsanto Haul Road	42 49 12.96	111 29 48.71	2008	Alluvial 11-6	Spring	Primary
	MBW011	Ballard Creek	42 49 23.46	111 29 38.93	2008	Alluvial 15-10	Spring	Primary
	MBW026	Ballard, Western Shallow	42 50 01.91	111 29 54.83	2008	Alluvial 11-6	**	NA
	MBW027	Ballard, Western Deeper	42 50 02.23	111 29 54.34	2008	Alluvial 16-11	Spring	Primary
	MBW028	Torgesen	42 49 34.44	111 29 42.93	2008	Alluvial 21-16	Spring	Primary
	MBW032	Holmgren	42 49 33.92	111 28 11.14	2008	Alluvial 15-10	Spring	Primary
	MBW048	Wooley Valley Creek	42 50 03.76	111 27 56.21	2008	Alluvial 9-4	Spring	Primary
	MBW130	East of Ballard Mine, along Wooley Valley Creek	42 49 40.00	111 27 10.00	2009	Alluvial 25-20	Spring	Primary
	MBW131	Northeast of Ballard Mine, near MST093	42 50 24.00	111 28 33.00	2009	Alluvial 8-3	Spring	Primary
	MBW135	Southeast of Ballard Mine, across Blackfoot River Road	42 48 40.00	111 29 43.00	2009	Alluvial 20-15	Spring	Primary
	MMW006	South of West Ballard Pit; south of waste rock dumps	42 49 20.00	111 29 03.00	2007	Wells Formation 330-310	Spring	Primary
	MMW017	Northwest of Ballard Mine into Long Valley Creek alluvial flow field	42 49 59.60	111 29 47.40	2007	Alluvial 56-36	Spring	Primary
	MMW018	East of Ballard Mine in Wooley Valley alluvial flow field	42 49 39.40	111 28 04.50	2007	Alluvial/ Dinwoody Formation 33-18	Spring	Primary
	MMW020	East side of West Ballard Pit (MMP035); replacement of MMW001	42 49 36.40	111 29 03.30	2007	Wells Formation 408-388	Spring	Primary
	MMW021	West side of West Ballard Pit (MMP035); replacement of MMW002	42 49 35.60	111 29 23.90	2007	Wells Formation 250-230	Spring	Primary
	MMW029	East Ballard mine area in the vicinity of MMW018	42 49 37.78	111 28 08.74	2008	Dinwoody Formation 60-45	Spring/ TBD	Primary
	MMW030	Along the southwestern portion of Ballard Mine in the vicinity of MMW016A	42 49 10.72	111 29 17.03	2008	Wells Formation 155-135	Spring	Primary
	MMW031	Along the western perimeter of Ballard Mine in the vicinity and north of MMW017	42 50 11.87	111 29 43.05	2008	Wells Formation 200-180	Spring	Primary

TABLE 3

GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE

Mine	Station ID	Station Description	Location		Well Install Year	Groundwater System Monitored Screened Interval (ft bgs)	Spring/ Fall	Analyte List
			Latitude	Longitude				
	MMW032	Adjacent to MWD084	42 50 09.30	111 28 21.80	2009	Dinwoody Formation65-55	Spring	Primary
	MMW033	Deeper well nested with MMW029	42 49 35.30	111 2811.90	2009	Dinwoody Formation 150-130	Spring	Primary
	MW-15A	West Ballard Mine near MST068	42 49 35.99	111 29 36.55	2006	Alluvial 40-30	Spring	Primary
	MW-16A	Southwest Ballard Mine near MST069	42 49 08.83	111 29 16.53	2006	Alluvial 30-20	Spring	Primary
Henry Mine	MBW152	North Henry Mine, along Little Blackfoot River	42 54 14.00	111 29 23.00	2009	Alluvial 15-10	Spring	Primary
	MMW004	North of Henry Mine north pit	42 54 07.70	111 29 46.50	before 2007*	Alluvial/ Dinwoody Formation No screen	**	NA
	MMW010	Southeast of Center Henry Pit; near MPW023	42 52 22.30	111 27 51.30	2007	Alluvial 32-12	Spring/ TBD	Primary
	MMW011	Northwest of Center Henry Pit; south of Little Blackfoot River	42 53 48.30	111 29 30.00	2007	Wells Formation 115-95	Spring	Primary
	MMW014	Southeast of Henry Mine center pit in Lone Pine Creek alluvial flow field	42 51 59.30	111 27 05.20	2007	Alluvial 22-7	**	NA
	MMW019	North of Henry Mine center pit	42 53 50.20	111 29 25.40	2007	Phosphoria Formation 14-4	**	NA
	MMW022	Northeast lobe of Henry Mine waste rock dump MWD086	42 53 09.20	111 28 18.30	2007	Dinwoody Formation 326-306	Spring	Primary
	MMW023	Henry Mine North Pit	42 54 20.50	111 30 27.50	2007	Wells Formation 357-352	Spring	Primary
	MMW028	Near the Little Blackfoot River northwest of MMW019	42 53 50.24	111 28 60.00	2008	Dinwoody Formation 96-76	Spring	Primary
Enoch Valley Mine	MBW085	Rasmussen Creek	42 51 55.52	111 24 04.12	2008	Alluvial 12.25-7.25	Spring	Primary
	MBW087	Rasmussen Road and Agrium Haul Road intersection	42 51 38.34	111 23 44.32	2008	Alluvial 12-7	Spring	Primary
	MBW099	Agrium Haul Road North	42 51 57.08	111 23 28.14	2008	Alluvial 29-24	Spring	Primary
	MBW107	Western Enoch Valley, East of fence	42 53 28.32	111 25 55.86	2008	Alluvial 40-35	Spring	Primary
	MBW112	Western Enoch Valley, west of fence	42 53 34.67	111 26 13.72	2008	Alluvial 18-13	***	Primary
	MMW007	South of EVM South Dump; near edge of dump footprint	42 51 48.50	111 23 34.40	2007	Alluvial/ Dinwoody Formation 90-70	Spring	Primary
	MMW008	South of EVM South Dump; south and	42 51 48.60	111 23 29.80	2007	Alluvial/ Dinwoody	**	NA

TABLE 3 GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE								
Mine	**Station ID**	**Station Description**	**Location**		**Well Install Year**	**Groundwater System Monitored Screened Interval (ft bgs)**	**Spring/ Fall**	**Analyte List**
			Latitude	**Longitude**				
		downgradient of MMW007				Formation 197-177		
	MMW009	Central North Dump (MWD091)	42 53 34.60	111 25 33.80	2007	Wells Formation 554-549	Spring	Primary
	MMW012	Northwest of EVM North Dump in Lone Pine Creek alluvial flow field	42 53 28.75	111 25 53.34	2007	Alluvial/ Dinwoody Formation 52-28	***	Primary
	MMW013	Southwest of EVM in Rasmussen Creek alluvial flow field	42 52 05.70	111 24 12.00	2007	Dinwoody Formation 35-25	Spring/ TBD	Primary
	MMW024	Along the south end of Enoch Valley Mine, near MMW013	42 52 11.73	111 24 11.86	2008	Dinwoody Formation 200-180	Spring	Primary
	MMW025	Along the south end of Enoch Valley Mine, near MMW007	42 51 49.16	111 23 31.95	2008	Dinwoody Formation 200-180	Spring	Primary
	MMW026	Northeast of MPW006/MMW008	42 51 56.48	111 23 25.75	2008	Wells Formation 355-335	Spring	Primary
	MMW027	Near MMW012	42 53 28.97	111 25 53.50	2008	Dinwoody Formation 120-100	Spring	Primary
	MMW034	Deeper well nested with MMW013	42 52 09.10	111 24 14.80	2009	Dinwoody Formation 156-136	Spring	Primary
	MMW035	Deeper well nested with MMW027	42 53 29.50	111 25 54.30	2009	Dinwoody Formation 199 – 179	Spring	Primary
	MMW036	Well west of MMW027	42 53 26.70	111 26 05.60	2009	Basalt 135 – 115	Spring	Primary
	MMW037	Nested with MMW036	42 53 26.14	111 26 06.82	2010	Dinwoody 302 – 292	Spring	Expanded
Agriculture Domestic and Production wells[a]	MPW019	EVM shop/office	42 52 37.40	111 25 16.52	1990	Dinwoody or Thaynes 17.5-235	Spring	Regular
	MAW001	School Bus Well	42 53 15.00	111 26 39.99	ND	ND ND	TBD	Regular
	MAW002	(b) (6) [redacted] Field Well	42 53 51.00	111 26 41.99	1969	Alluvium[b] 14-146	TBD	Regular
	MAW003	(b) (6) [redacted] Field Well	42 53 24.00	111 27 21.59	1987	Thaynes[c] 20-30/ 160-180	TBD	Regular
	MAW004	(b) (6) [redacted] Field Well	42 51 57.01	111 29 22.21	ND	ND ND	TBD	Regular
	MAW005	(b) (6) [redacted] Field Well	42 51 44.32	111 23 08.79	1990	Alluvium, Wells[b] 159-239	TBD	Regular
	MAW006	(b) (6) [redacted] Field Well West	42 51 59.54	111 30 49.85	1988	Basalt[b] 89-109	TBD	Regular
	MAW007	(b) (6) [redacted] Field Well North	42 52 29.99	111 29 49.20	1988	Alluvium[b] 59-119	TBD	Regular

TABLE 3

GROUNDWATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE

Mine	Station ID	Station Description	Location		Well Install Year	Groundwater System Monitored Screened Interval (ft bgs)	Spring/ Fall	Analyte List
			Latitude	Longitude				
	MDW001	Peterson House Well	42 53 24.00	111 27 25.99	1987	Travertine[b] 70-110/139-160	TBD	Regular
	MDW002	Thompson House Well	42 54 17.97	111 26 46.58	1987	Alluvium, Thaynes[b] 20-30/160-280	TBD	Regular
	MDW003	Taylor House Well	42 52 29.99	111 26 45.99	ND	ND ND	TBD	Regular
	MDW004	Godfrey House Well	42 49 26.39	111 33 14.40	ND	ND ND	TBD	Regular
	MDW005	Cedar Bay RV Park Well	42 54 32.40	111 31 51.59	1969	Alluvium, Travertine[b] 40-45	TBD	Regular
	MDW006	Ellis House Well	42 54 43.20	111 28 47.99	ND	ND ND	TBD	Regular

Notes:

MBW - Borehole Monitoring Well (direct-push pre-packed screen monitoring well)
MMW - Monitoring Well
NA - Not Applicable
ND - Not Determined
TBD - To Be Determined

[a] Agricultural, domestic and production wells will be sampled later in 2012 as deemed practical and dependent on access. .
[b] Formation was interpreted from logs and geologic maps, so some wells may be open to multiple formations.
[c] Well logs were not found for these agricultural and domestic wells, so construction information is limited

* - Exact date of installation is not known for MMW004
** - Water level to be monitored
*** - Water level to be monitored, if groundwater is present, sampling of this well will be considered following consultation with the A/T.

Not proposed for sampling in 2012 and was not sampled in 2010.

ATTACHMENT 1
2009 AND 2010 SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN

ATTACHMENT 2
2009 GROUNDWATER MONITORING
SAMPLING AND ANALYSIS PLAN

ATTACHMENT 3
2010 GROUNDWATER MONITORING MEMORANDUM

ATTACHMENT 5
2013 LTM PLAN

MWH

BUILDING A BETTER WORLD

April 16, 2013

Mr. Dave Tomten
U.S. Environmental Protection Agency
1435 N. Orchard Street
Boise, ID 83706

RE: Proposed P4 Long-Term Surface Water and Groundwater Monitoring Plan - Final Rev1

Dear Dave:

This memorandum presents the proposed long-term surface water (SW) and groundwater (GW) monitoring plans at the P4 Production, L.L.C. (P4) mine site north of Soda Springs, Idaho. This monitoring program is being performed in accordance with the requirements in the Administrative Settlement Agreement and Order on Consent/Consent Order for the Remedial Investigation/Feasibility Study (2009 AOC/ CO; RI/FS) with the US Environmental Protection Agency (USEPA) Region 10 and other named federal and state agencies.

P4's mine site includes the inactive properties of Ballard, Henry, and Enoch Valley mines, collectively referred to as the Sites, which are the focus of the AOC/CO. The SW and GW monitoring program proposed in this letter is intended to transition the past sampling programs from interim plans and site characterization to a long term monitoring (LTM) program. As conducted in the past, it is anticipated that the LTM program for groundwater and surface water sampling will be performed during two sampling rounds each year; one in the spring for both SW and GW and the other in the fall for SW only. The LTM program will begin this year and data collected will serve to support the RI/FS process including the evaluation of the individual mine site remedies during the FS and to document individual Site changes that might be expected following implementation of the Selected Remedy. The proposed LTM SW and GW monitoring objectives and program are described in more detail below.

Proposed Long-Term Monitoring Program for Surface Water

The objective of SW monitoring conducted at the Sites from 2004 through 2008 was to support nature and extent characterizations of impacts to water quality associated with releases to SW from potential sources. In 2009, the SW monitoring program transitioned from a characterization program to an interim monitoring plan that provides an annual assessment of SW conditions downstream of potential sources associated with each Site. The objective of the sampling conducted since 2009 is to establish long-term data trends and assist with the development of site-specific remedies at individual mines. The details of the 2009/2010 interim monitoring plan, including data quality objectives (DQOs) and the field sampling plan (FSP), are included in the A/T-approved *2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan - Final Revision 2* (*2009/2010 Surface Water SAP*; MWH, 2009a). This document is included as Attachment 1.

Additional sampling also was performed in 2012 under the A/T-approved technical memorandum entitled *2012 Surface and Groundwater Monitoring Programs - Final Revision 2* (*2012 Surface Water and Groundwater Memo*; MWH, 2012a). The objectives of the 2012 monitoring were the same as the 2009/2010 monitoring program and these same objectives are proposed for the current LTM program.

The 2013 and future monitoring program will follow the 2009/2010 and 2012 monitoring programs with the following exceptions for SW:

- Background stations MST048 and MST093 will not be included as part of the LTM program. These stations were sampled in 2012 to support the evaluation of background concentrations for constituents of potential concern (COPCs) and constituents of potential ecological concern

(COPECs). The background evaluations were completed in 2012 as documented in the December 21, 2012, *Ballard, Henry, and Enoch Valley Mines Remedial Investigation and Feasibility Study Background Levels Development Technical Memorandum* (MWH, 2012b). Because these evaluations are complete and historical and current sampling data exists, annual long-term monitoring of these background stations is not warranted.

- Dissolved selenium will be included in the analyte list for all SW stations to assist evaluation of samples that may have high turbidity/suspended solids.

The key elements of the LTM monitoring program for both SW and GW are summarized on Table 1 - *Surface Water and Groundwater Analyte List,* Table 2 - *Surface Water Monitoring Locations, Frequency and Schedule*, and Table 3 - *LTM Spring Sample Tracker for Surface Water Stations.* The sample collection and analysis will be performed according to the methods and procedures outlined in the *2009/2010 Surface Water SAP and FSP* included as Attachment 1 to this letter. Figure 1 presents the LTM SW locations on a topographic map with all three Sites included. Figures 2 through 4 present the SW locations on an aerial, photographic background for each individual Site.

As shown on Table 2, a subset of the SW monitoring locations will be re-evaluated after the spring LTM sampling event to determine whether they will be sampled in the fall LTM sampling event. Those sampling locations with consistently higher selenium and sulfate concentrations in the fall, as compared to spring, will be retained for fall sampling. The fall sampling decision will use both the spring LTM data and historical data to determine which stations, if any, need to be re-sampled in the fall. If any of the stations need to be re-sampled in the fall, a LTM Fall Sample Tracker table will be developed and each of the locations with be visited. The LTM Fall Sample Tracker table and rationale for fall stations will be provided to the A/T at least three weeks prior to the fall sample event. On dry or drought years many/most of the selected locations will be dry during the fall round of sampling and as a result, no sample will be collected at those locations that are dry.

Proposed Long-Term Monitoring Program for Groundwater

Characterization of GW at the Sites has been conducted in a phased approach since 2004 and the spatial/categorical relevance of individual GW monitoring locations and the analyte list were evaluated as part of the

- *2009 Groundwater Monitoring Sampling and Analysis Plan (2009 Groundwater SAP; MWH, 2009b),*
- *2010 Groundwater Monitoring Memorandum (2010 Groundwater Memo; MWH, 2010)*, and the
- *2012 Surface Water and Groundwater Memo.*

These plans are included as Attachments 2, 3, and 4 to this letter. The objectives of the GW monitoring that occurred in the 2010 and 2012 sampling programs are essentially the same. The groundwater data collected under these plans support the evaluation of SW / GW interaction and refinement of the hydrogeologic conceptual models of the Sites. However, continued ongoing LTM monitoring of contaminants of COPC concentrations and piezometric conditions in monitoring wells is needed to support the evaluation of remedies in the FS and implementation of the sites Selected Remedies during any corrective action that may be necessary. Sampling of these GW locations also allows for an understanding of potential long-term trends, especially following the implementation of the Selected Remedy at each of the Sites.

The LTM GW program will mimic the 2010 and 2012 programs with the following two exceptions:

- Specific agricultural, domestic, and production wells were included in 2012 in order to support the evaluation of groundwater background concentrations. The background evaluations were completed in 2012 as documented in the *Ballard, Henry, and Enoch Valley Mines Remedial Investigation and Feasibility Study Background Levels Development Technical Memorandum (dated December 21, 2012).* Because the background evaluations are complete as documented in the A/T approved *Background Levels Development Technical Memorandum for Ballard, Henry and Enoch Valley Mines (Final, Rev0)* and no selenium exceedances were reported during three sampling events (2004, 2008, and 2012), annual long-term monitoring of these wells is not warranted, although we understand that the A/Ts can request monitoring of these locations at any time. As of 2012, all wells have been sampled for the regular and expanded list of analytes (see Table 2 of the *2010 Groundwater SAP*). As part of the LTM program, all groundwater monitoring wells will be sampled for the primary analyte list (see Table 1). In addition, total manganese was added to the primary analyte list in 2012. This addition to the primary list will be included in the LTM program, but will be re-evaluated based on future sampling results to determine if continued monitoring of manganese concentrations is warranted. Similar to surface water, dissolved selenium will be included in the analyte list for all GW stations to assist evaluation of well samples that may have high turbidity/suspended solids which could affect the analytical results leading to misinterpretation of the data.

The key elements of the LTM groundwater monitoring program are summarized on Table 1, *Surface Water and Groundwater Analyte List*, Table 4, *Groundwater Locations, Frequency and Schedule*, and Table 5 - *LTM Spring Sample Tracker for Groundwater Stations*. As shown on Table 4, no fall GW sampling is proposed. As discussed last year, a review of historical selenium and sulfate data does not support additional fall GW sampling events. The GW sample collection and analysis will be performed according to the methods and procedures outlined within the *2009 Groundwater Monitoring SAP* (Attachment 2). Figure 1 presents the LTM GW locations on a topographic map with all three Sites included. Figures 2 through 4 present the GW locations on an aerial, photographic background for each individual Site.

P4 will continue to submit all validated data and data validation summaries for each sampling effort within 120 days of sample collection as required by Task B Data Management in the 2009 AOC/CO Scope of Work (SOW). In addition yearly Data Summary Reports will be submitted to the A/T per the SOW. We appreciate your timely review of the proposed sampling program. The complete A/T comments and P4 responses as well as your conditional approval letter are included in Attachment 5. P4 anticipates sampling to begin in April 2013 based on snowpack and runoff conditions. If you have any questions or comments on this proposed sampling event, please do not hesitate to contact Rachel Roskelley at (208) 547-1248, or me at (801) 617-3250.

Best Regards,

Vance K Drain

Vance Drain, P.G.
Project Manager

Distribution:

Dave Tomten, USEPA
Tim Mosko, CH2M Hill
Michael Rowe, IDEQ
Gerry Winter, IDEQ
Mary Kauffman, USDA-FS
Caribou National Forest, Soda Springs District Office
James Alexander, USDA
Kelly Wright, Shoshone-Bannock Tribes
Sandi Fisher, USFWS
Susan Hanson, Shoshone-Bannock Tribes
Colleen O'Hara, BLM
Celeste Christensen, MWH
Bruce Narloch, MWH
MWH Project File
Joe Wallace, USEPA
Lorraine Edmond, USEPA
Marcy Pearhill, IDEQ
Sherri Clark, FS
Eldine Stevens, BIA
Gary Billman, IDL
Carolann Cole, North Wind Inc.
Mike Vice, Monsanto
Randy Vranes, Monsanto/P4
Rachel Roskelley, Monsanto/P4
Randy White, Monsanto
Dale Ralston, RHS
Cary Foulk, MWH
Vance Drain, MWH

References

2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan - Final Revision 2 (2009/2010 Surface Water SAP; MWH, 2009a).

2009 Groundwater Monitoring Sampling and Analysis Plan (2009 Groundwater SAP; MWH, 2009b),

2010 Groundwater Monitoring Memorandum (2010 Groundwater Memo; MWH, 2010)

2012 Surface and Groundwater Monitoring Programs - Final Revision 2 (2012 Surface Water and Groundwater Memo; MWH, 2012).

Ballard, Henry, and Enoch Valley Mines Remedial Investigation and Feasibility Study Background Levels Development Technical Memorandum (MWH, 2013).

FIGURES

TABLES

TABLE 1
LTM SURFACE WATER AND GROUNDWATER
ANALYTE LIST

Category	Fraction	Analytes (Analytical Method)
Surface Water		
Streams , Seeps, and Springs,	Unfiltered Filtered Filtered Filtered Filtered Unfiltered Unfiltered	Se (EPA 6020A) Cd, Se (EPA 6020A) V (EPA 6010B) Ca, Mg (EPA 6010B)[a] SO_4 (EPA 300.0) TDS (EPA 160.1) Field Parameters[b]
Groundwater		
Monitoring Wells and Direct Push Borehole Wells[c]	 Unfiltered[d] Filtered Filtered Unfiltered Unfiltered	*Primary Analyte List* Cd, Mn, Se (EPA 6020A) Se (EPA 6020A) SO_4 (EPA 300.0) TDS (EPA 160.1) Field Parameters[b]

Notes:

[a]Hardness is calculated on filtered fractions of Ca and Mg

[b]Field parameters are listed on Table 3 and Table 5.

[c]Borehole Monitoring Wells (direct push) are differentiated from "regular or standard" monitoring wells based on their methods and means of completion. In general, they have a smaller diameter and a shorter pre-packed screened interval than the regular monitoring wells.

[c]Direct-push monitoring wells may be sampled for dissolved or dissolved and total fractions depending on turbidity (see *2010 Groundwater SAP*).

Ca - Calcium
Cd - Cadmium
Mg – Magnesium
Mn – Manganese
Se - Selenium
SO_4 - Sulfate
TDS - Total Dissolved Solids
V - Vanadium

TABLE 2 LTM SURFACE WATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE						
Mine	**Station ID[a]**	**Feature Name[b]**	**Location[c]**		**Sample Schedule**	
			Latitude	**Longitude**	**Spring**	**Fall[d]**
Ballard Mine	MST019	Blackfoot River below Ballard Creek	42 48 49.28	111 30 21.52	X	TBD
	MST020	Blackfoot River below State Land Creek	42 48 31.97	111 30 06.28	X	TBD
	MST050	*Long Valley Creek* below Ballard Mine	42 50 54.00	111 29 49.00	X	
	MST066	*Ballard Creek* above Blackfoot River	42 48 56.30	111 30 07.32	X	
	MST067	*Ballard Creek* headwaters	42 49 23.79	111 29 36.31	X	
	MST069	*Short Creek* below Ballard Mine	42 49 11.23	111 29 19.75	X	TBD
	MST089	*Wooley Valley Creek*, below *North Fork Wooley Valley Creek*	42 49 28.70	111 26 19.40	X	
	MST090	*Wooley Valley Creek*, above *North Fork Wooley Valley Creek*	42 49 28.00	111 26 49.00	X	
	MST092	*North Fork Wooley Valley Creek* above *Wooley Valley Creek*	42 49 40.00	111 27 04.30	X	
	MST094	*Spring-fed trib. #1 of N. Fork Wooley Valley Cr.,* below Ballard Mine	42 49 56.00	111 28 10.00	X	
	MST095	*Spring-fed trib. #2 of N. Fork Wooley Valley Cr.,* below Ballard Mine	42 49 39.00	111 28 05.00	X	
	MST096	Tributary of North Fork Wooley Valley Creek, below Ballard Mine	42 49 30.00	111 27 45.00	X	
	MDS030	*Pit #2 Upper Dump Seep*	42 49 44.25	111 29 20.95	X	TBD
	MSG004	*Holmgren Spring*	42 49 16.75	111 28 16.04	X	TBD
	MSG005[f]	*Cattle Spring*	42 49 19.07	111 28 01.90	X	
	MSG006	*Southeast Spring*	42 49 41.43	111 27 51.34	X	
	MSG007	*South of Southeast Spring*	42 49 38.19	111 27 42.68	X	
Henry Mine	MST044	Immediately below Henry Mine (1997 #24)	42 53 50.60	111 29 24.80	X	TBD
	MST045	Little Blackfoot River above Henry Creek	42 54 10.70	111 29 30.10	X	TBD
	MST051	East Fork Long Valley Creek below Henry Mine	42 52 18.23	111 28 58.49	X	
	MST057	West Fork Lone Pine Creek above Lone Pine Creek	42 51 59.49	111 26 21.78	X	
	MST063	Strip Mine Creek below Henry Mine	42 52 01.70	111 27 03.40	X	
	MST226	Tributary to Lone Pine Creek	42 51 42.27	111 25 55.16	X	
	MST275	Tributary to Lone Pine Creek	42 51 56.33	111 25 04.24	X	TBD
	MDS034	Henry Mine, Dump Seep #3	111 29 23.87	42 53 46.90	X	TBD
Enoch Valley Mine	MST128	*Angus Creek* above Rasmussen Creek	42 51 08.00	111 22 32.00	X	
	MST131	*Rasmussen Creek* above Angus Creek	42 51 08.00	111 22 31.00	X	
	MST132	Angus Creek Above *No Name Creek* and below *Rasmussen Creek*	42 51 07.00	111 22 29.00	X	
	MST133	*Rasmussen Creek* below Enoch Valley Mine	42 51 48.00	111 23 50.00	X	
	MST136	*Rasmussen Creek* headwaters near *Enoch Valley Mine Shop Pond*	42 52 34.00	111 25 03.00	X	

TABLE 2
LTM SURFACE WATER MONITORING LOCATIONS, FREQUENCY, AND SCHEDULE

Mine	Station ID[a]	Feature Name[b]	Location[c]		Sample Schedule	
			Latitude	Longitude	Spring	Fall[d]
	MST143	*East Fork Rasmussen Creek* above *Rasmussen Creek*	42 51 31.70	111 23 01.40	X	
	MST144	*West Pond Creek headwaters*, below West Pond	42 52 16.07	111 24 18.66	X	TBD
	MST269	*East Fork Rasmussen Creek* headwaters	42 52 16.57	111 23 41.69	X	
	MST274	West Fork of Rasmussen Creek	42 51 31.00	111 23 34.00	X	TBD
	MDS025	West Dump Seep	42 52 13.00	111 24 11.00	X	TBD
	MDS026	South Dump Seep	42 51 54.20	111 23 36.27	X	TBD

MDS - Dump Seep
MSG - Spring
MST – Stream
TBD - To be determined

[a]Table does not include all available surface water monitoring locations at the P4 Sites, only those locations identified for continued monitoring

[b] Stream names in *italics* were assigned by either IMA or P4 Production as these streams are unnamed on USGS maps or, as far as is known, are unnamed by common usage of local inhabitants. The reason for this is that most such streams are small with intermittent or ephemeral flows.

[c]Location (GPS) coordinates use the NAD27 datum and are presented in ddd mm ss.ss format (degrees minutes seconds).

[d]Fall sampling program will be evaluated based on the recent year historical results and will follow the protocol set forth in the 2009 and 2010 Surface Water SAP.

Table 3
Spring LTM Sample Tracker for Surface Water Stations
(Page 1 of 4)

					Lab Parameters - Analyte List						Field Parameters										
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd, Se (SW6020A)	Dissolved Ca, Mg, V (SW6010B/C)	Dissolved SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (ºC)	Air Temperature (ºC)	Discharge (ft^3/sec)	Date Sampled
SWMDS025-U	MDS025	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMDS025-F	MDS025	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMDS026-U	MDS026	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMDS026-F	MDS026	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMDS030-1-U	MDS030	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMDS030-1-F	MDS030	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMDS030-2-U	MDS030	Water	Unfiltered	Duplicate	X				X		X	X	X	X	X	X	X	X	X	X	
SWMDS030-2-F	MDS030	Water	Filtered	Duplicate		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMDS034-U	MDS034	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMDS034-F	MDS034	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMSG004-U	MSG004	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMSG004-F	MSG004	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMSG004-U-MS	MSG004	Water	Unfiltered	MS	X				X		X	X	X	X	X	X	X	X	X	X	
SWMSG004-F-MS	MSG004	Water	Filtered	MS		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMSG004-U-MSD	MSG004	Water	Unfiltered	MSD	X				X		X	X	X	X	X	X	X	X	X	X	
SWMSG004-F-MSD	MSG004	Water	Filtered	MSD		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMSG005-U	MSG005	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMSG005-F	MSG005	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMSG006-U	MSG006	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMSG006-F	MSG006	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMSG007-U	MSG007	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMSG007-F	MSG007	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST019-U	MST019	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST019-F	MST019	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST020-U	MST020	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST020-F	MST020	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST044-U	MST044	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST044-F	MST044	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST045-1-U	MST045	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST045-1-F	MST045	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST045-2-U	MST045	Water	Unfiltered	Duplicate	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST045-2-F	MST045	Water	Filtered	Duplicate		X	X	X		X	X	X	X	X	X	X	X	X	X	X	

Table 3
Spring LTM Sample Tracker for Surface Water Stations
(Page 2 of 4)

					Lab Parameters - Analyte List							Field Parameters										
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd, Se (SW6020A)	Dissolved Ca, Mg, V (SW6010B/C)	Dissolved SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)		Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (ºC)	Air Temperature (ºC)	Discharge (ft^3/sec)	Date Sampled
SWMST050-U	MST050	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST050-F	MST050	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST051-U	MST051	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST051-F	MST051	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST057-U	MST057	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST057-F	MST057	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST063-U	MST063	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST063-F	MST063	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST063-U-MS	MST063	Water	Unfiltered	MS	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST063-F-MS	MST063	Water	Filtered	MS		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST063-U-MSD	MST063	Water	Unfiltered	MSD	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST063-F-MSD	MST063	Water	Filtered	MSD		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST066-U	MST066	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST066-F	MST066	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST067-U	MST067	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST067-F	MST067	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST069-U	MST069	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST069-F	MST069	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST089-U	MST089	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST089-F	MST089	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST089-U-MS	MST089	Water	Unfiltered	MS	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST089-F-MS	MST089	Water	Filtered	MS		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST089-U-MSD	MST089	Water	Unfiltered	MSD	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST089-F-MSD	MST089	Water	Filtered	MSD		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST090-U	MST090	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST090-F	MST090	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST092-U	MST092	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST092-F	MST092	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST094-U	MST094	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST094-F	MST094	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST095-U	MST095	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST095-F	MST095	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	
SWMST096-U	MST096	Water	Unfiltered	Primary	X				X			X	X	X	X	X	X	X	X	X	X	
SWMST096-F	MST096	Water	Filtered	Primary		X	X	X		X		X	X	X	X	X	X	X	X	X	X	

Table 3
Spring LTM Sample Tracker for Surface Water Stations
(Page 3 of 4)

					Lab Parameters - Analyte List						Field Parameters										
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd, Se (SW6020A)	Dissolved Ca, Mg, V (SW6010B/C)	Dissolved SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (ºC)	Air Temperature (ºC)	Discharge (ft^3/sec)	Date Sampled
SWMST128-U	MST128	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST128-F	MST128	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST131-U	MST131	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST131-F	MST131	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST132-1-U	MST132	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST132-1-F	MST132	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST132-2-U	MST132	Water	Unfiltered	Duplicate	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST132-2-F	MST132	Water	Filtered	Duplicate		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST133-U	MST133	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST133-F	MST133	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST136-U	MST136	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST136-F	MST136	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST143-U	MST143	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST143-F	MST143	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST144-U	MST144	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST144-F	MST144	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST226-U	MST226	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST226-F	MST226	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST269-U	MST269	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST269-F	MST269	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST274-U	MST274	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST274-F	MST274	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
SWMST275-U	MST275	Water	Unfiltered	Primary	X				X		X	X	X	X	X	X	X	X	X	X	
SWMST275-F	MST275	Water	Filtered	Primary		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
ER-SW-01-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-01-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-02-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-02-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-03-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-03-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-04-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-04-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-05-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-05-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											

Table 3
Spring LTM Sample Tracker for Surface Water Stations
(Page 4 of 4)

					Lab Parameters - Analyte List						Field Parameters										
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Selenium (SW6020A)	Dissolved Cd, Se (SW6020A)	Dissolved Ca, Mg, V (SW6010B/C)	Dissolved SO4 (E300.0)	TDS (E160.1)	Dissolved Hardness (SM2340B-Calc)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (ºC)	Air Temperature (ºC)	Discharge (ft^3/sec)	Date Sampled
ER-SW-06-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-06-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-07-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-07-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-08-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-08-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-09-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-09-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-10-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-10-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-11-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-11-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-12-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-12-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-13-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-13-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
ER-SW-14-U	na	Water	Unfiltered	Equip Rinsate	X				X												
ER-SW-14-F	na	Water	Filtered	Equip Rinsate		X	X	X		X											
B-SW-01-U	na	Water	Unfiltered	Source Water	X				X												
B-SW-01-F	na	Water	Filtered	Source Water		X	X	X		X											

Ca - Calcium	µS/cm	microsiemens per centimeter	°C	Degrees celsius
Cd - Cadmium	% sat	percent saturation	ft3/sec	cubic feet per second
Mn - Manganese	mg/L	Milligrams per liter		
Se - Selenium	mV	Millivolts		
SO4 - Sulfate	ftu	Formazin Turbidity Unit		

TDS - Total Dissolved Solids
V - Validium
ER - equipment rinsate blank sample, to be taken once per field team per day, total ERs taken may not add up to what is accounted for here
B – source water blank sample, to be taken once per field effort
ID - identification
na - not applicable
QC - quality control
[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2013 would have a prefix of (1306) followed by the normal sample ID.

TABLE 4

LTM GROUNDWATER MONITORING WELL AND BOREHOLE WELL LOCATIONS

Mine	Station ID	Station Description	Location		Well Install Year	Groundwater System Monitored Screened Interval (ft bgs)	Sample Schedule	Analyte List
			Latitude	Longitude				
Ballard Mine	MBW006	Short Creek	42 49 04.15	111 29 25.80	2008	Alluvial 14-9	Spring	Primary*
	MBW009	Blackfoot River Road @ Monsanto Haul Road	42 49 12.96	111 29 48.71	2008	Alluvial 11-6	Spring	Primary
	MBW011	Ballard Creek	42 49 23.46	111 29 38.93	2008	Alluvial 15-10	Spring	Primary
	MBW027	Ballard, Western Deeper	42 50 02.23	111 29 54.34	2008	Alluvial 16-11	Spring	Primary
	MBW028	Torgesen	42 49 34.44	111 29 42.93	2008	Alluvial 21-16	Spring	Primary
	MBW032	Holmgren	42 49 33.92	111 28 11.14	2008	Alluvial 15-10	Spring	Primary
	MBW048	Wooley Valley Creek	42 50 03.76	111 27 56.21	2008	Alluvial 9-4	Spring	Primary
	MBW130	East of Ballard Mine, along Wooley Valley Creek	42 49 40.00	111 27 10.00	2009	Alluvial 25-20	Spring	Primary
	MBW131	Northeast of Ballard Mine, near MST093	42 50 24.00	111 28 33.00	2009	Alluvial 8-3	Spring	Primary
	MBW135	Southeast of Ballard Mine, across Blackfoot River Road	42 48 40.00	111 29 43.00	2009	Alluvial 20-15	Spring	Primary
	MMW006	South of West Ballard Pit; south of waste rock dumps	42 49 20.00	111 29 03.00	2007	Wells Formation 330-310	Spring	Primary
	MMW017	Northwest of Ballard Mine into Long Valley Creek alluvial flow field	42 49 59.60	111 29 47.40	2007	Alluvial 56-36	Spring	Primary
	MMW018	East of Ballard Mine in Wooley Valley alluvial flow field	42 49 39.40	111 28 04.50	2007	Alluvial/ Dinwoody Formation 33-18	Spring	Primary
	MMW020	East side of West Ballard Pit (MMP035); replacement of MMW001	42 49 36.40	111 29 03.30	2007	Wells Formation 408-388	Spring	Primary
	MMW021	West side of West Ballard Pit (MMP035); replacement of MMW002	42 49 35.60	111 29 23.90	2007	Wells Formation 250-230	Spring	Primary
	MMW029	East Ballard mine area in the vicinity of MMW018	42 49 37.78	111 28 08.74	2008	Dinwoody Formation 60-45	Spring	Primary
	MMW030	Along the southwestern portion of Ballard Mine in the vicinity of MMW016A	42 49 10.72	111 29 17.03	2008	Wells Formation 155-135	Spring	Primary
	MMW031	Along the western perimeter of Ballard Mine in the vicinity and north of MMW017	42 50 11.87	111 29 43.05	2008	Wells Formation 200-180	Spring	Primary
	MMW032	Adjacent to MWD084	42 50 09.30	111 28 21.80	2009	Dinwoody Formation65-55	Spring	Primary

TABLE 4 LTM GROUNDWATER MONITORING WELL AND BOREHOLE WELL LOCATIONS								
Mine	Station ID	Station Description	Location		Well Install Year	Groundwater System Monitored Screened Interval (ft bgs)	Sample Schedule	Analyte List
			Latitude	Longitude				
	MMW033	Deeper well nested with MMW029	42 49 35.30	111 2811.90	2009	Dinwoody Formation 150-130	Spring	Primary*
	MW-15A	West Ballard Mine near MST068	42 49 35.99	111 29 36.55	2006	Alluvial 40-30	Spring	Primary
	MW-16A	Southwest Ballard Mine near MST069	42 49 08.83	111 29 16.53	2006	Alluvial 30-20	Spring	Primary
Henry Mine	MBW152	North Henry Mine, along Little Blackfoot River	42 54 14.00	111 29 23.00	2009	Alluvial 15-10	Spring	Primary
	MMW010	Southeast of Center Henry Pit; near MPW023	42 52 22.30	111 27 51.30	2007	Alluvial 32-12	Spring	Primary
	MMW011	Northwest of Center Henry Pit; south of Little Blackfoot River	42 53 48.30	111 29 30.00	2007	Wells Formation 115-95	Spring	Primary
	MMW022	Northeast lobe of Henry Mine waste rock dump MWD086	42 53 09.20	111 28 18.30	2007	Dinwoody Formation 326-306	Spring	Primary
	MMW023	Henry Mine North Pit	42 54 20.50	111 30 27.50	2007	Wells Formation 357-352	Spring	Primary
	MMW028	Near the Little Blackfoot River northwest of MMW019	42 53 50.24	111 28 60.00	2008	Dinwoody Formation 96-76	Spring	Primary
Enoch Valley Mine	MBW085	Rasmussen Creek	42 51 55.52	111 24 04.12	2008	Alluvial 12.25-7.25	Spring	Primary
	MBW087	Rasmussen Road and Agrium Haul Road intersection	42 51 38.34	111 23 44.32	2008	Alluvial 12-7	Spring	Primary
	MBW099	Agrium Haul Road North	42 51 57.08	111 23 28.14	2008	Alluvial 29-24	Spring	Primary
	MBW107	Western Enoch Valley, East of fence	42 53 28.32	111 25 55.86	2008	Alluvial 40-35	Spring	Primary
	MBW112	Western Enoch Valley, west of fence	42 53 34.67	111 26 13.72	2008	Alluvial 18-13	Spring	Primary
	MMW007	South of EVM South Dump; near edge of dump footprint	42 51 48.50	111 23 34.40	2007	Alluvial/ Dinwoody Formation 90-70	Spring	Primary
	MMW009	Central North Dump (MWD091)	42 53 34.60	111 25 33.80	2007	Wells Formation 554-549	Spring	Primary
	MMW012	Northwest of EVM North Dump in Lone Pine Creek alluvial flow field	42 53 28.75	111 25 53.34	2007	Alluvial/ Dinwoody Formation 52-28	Spring	Primary
	MMW013	Southwest of EVM in Rasmussen Creek alluvial flow field	42 52 05.70	111 24 12.00	2007	Dinwoody Formation 35-25	Spring	Primary
	MMW024	Along the south end of Enoch Valley Mine, near MMW013	42 52 11.73	111 24 11.86	2008	Dinwoody Formation 200-180	Spring	Primary

TABLE 4

LTM GROUNDWATER MONITORING WELL AND BOREHOLE WELL LOCATIONS

Mine	Station ID	Station Description	Location		Well Install Year	Groundwater System Monitored Screened Interval (ft bgs)	Sample Schedule	Analyte List
			Latitude	Longitude				
	MMW025	Along the south end of Enoch Valley Mine, near MMW007	42 51 49.16	111 23 31.95	2008	Dinwoody Formation 200-180	Spring	Primary*
	MMW026	Northeast of MPW006/MMW008	42 51 56.48	111 23 25.75	2008	Wells Formation 355-335	Spring	Primary
	MMW027	Near MMW012	42 53 28.97	111 25 53.50	2008	Dinwoody Formation 120-100	Spring	Primary
	MMW034	Deeper well nested with MMW013	42 52 09.10	111 24 14.80	2009	Dinwoody Formation 156-136	Spring	Primary
	MMW035	Deeper well nested with MMW027	42 53 29.50	111 25 54.30	2009	Dinwoody Formation 199 – 179	Spring	Primary
	MMW036	Well west of MMW027	42 53 26.70	111 26 05.60	2009	Basalt 135 – 115	Spring	Primary
	MMW037	Nested with MMW036	42 53 26.14	111 26 06.82	2010	Dinwoody 302 – 292	Spring	Primary

Notes:

MBW - Borehole Monitoring Well (direct-push pre-packed screen monitoring well)
MMW - Monitoring Well

* The primary analyte list is presented in Table 1 and includes analytes, fraction, and analytical methods for monitoring wells and direct push borehole wells.

Borehole Monitoring Wells (direct push) are differentiated from “regular or standard” monitoring wells based on their methods and means of completion. In general, the direct-push borehole monitoring wells have a smaller diameter and a shorter pre-packed screened interval than the regular monitoring wells.

Table 5
Spring LTM Sample Tracker for Monitoring Wells and Direct Push Borehole Wells
(Page 1 of 4)

					Lab Parameters - Primary Analyte List*					Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Mn, Se (SW6020A)	Dissolved Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Water Elevation (ft amsl)	Date Sampled
GWMBW006-U	MBW006	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW006-F	MBW006	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW009-U	MBW009	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW009-F	MBW009	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW011-U	MBW011	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW011-F	MBW011	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW027-U	MBW027	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW027-F	MBW027	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW028-U	MBW028	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW028-F	MBW028	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW032-1-U	MBW032	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW032-1-F	MBW032	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW032-2-U	MBW032	Water		Duplicate	X		X			X	X		X	X	X	X	X	X	
GWMBW032-2-F	MBW032	Water	X	Duplicate	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW048-U	MBW048	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW048-F	MBW048	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW085-U	MBW085	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW085-F	MBW085	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW087-1-U	MBW087	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW087-1-F	MBW087	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW099-U	MBW099	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW099-F	MBW099	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW107-U	MBW107	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW107-F	MBW107	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW112-U	MBW112	Water		Primary	TBD		TBD			X	X		X	X	X	X	X	X	
GWMBW112-F	MBW112	Water	X	Primary	TBD	TBD	TBD	TBD		X	X		X	X	X	X	X	X	
GWMBW130-U	MBW130	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW130-F	MBW130	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW131-U	MBW131	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW131-F	MBW131	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW135-U	MBW135	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW135-F	MBW135	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMBW152-U	MBW152	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMBW152-F	MBW152	Water	X	Primary	O	X	O	X		X	X		X	X	X	X	X	X	
GWMMW006-U	MMW006	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW006-F	MMW006	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	

Table 5
Spring LTM Sample Tracker for Monitoring Wells and Direct Push Borehole Wells
(Page 2 of 4)

					Lab Parameters - Primary Analyte List*					Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Mn, Se (SW6020A)	Dissolved Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Water Elevation (ft amsl)	Date Sampled
GWMMW007-U	MMW007	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW007-F	MMW007	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW007-U-MS	MMW007	Water		MS	X		X			X	X		X	X	X	X	X	X	
GWMMW007-F-MS	MMW007	Water	X	MS		X		X		X	X		X	X	X	X	X	X	
GWMMW007-U-MSD	MMW007	Water		MSD	X		X			X	X		X	X	X	X	X	X	
GWMMW007-F-MSD	MMW007	Water	X	MSD		X		X		X	X		X	X	X	X	X	X	
GWMMW009-U	MMW009	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW009-F	MMW009	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW010-U	MMW010	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW010-F	MMW010	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW011-U	MMW011	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW011-F	MMW011	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW012-U	MMW012	Water		Primary	TBD		TBD			X	X		X	X	X	X	X	X	
GWMMW012-F	MMW012	Water	X	Primary		TBD		TBD		X	X		X	X	X	X	X	X	
GWMMW013-U	MMW013	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW013-F	MMW013	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW017-U	MMW017	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW017-F	MMW017	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW018-U	MMW018	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW018-F	MMW018	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW018-U-MS	MMW018	Water		MS	X		X			X	X		X	X	X	X	X	X	
GWMMW018-F-MS	MMW018	Water	X	MS		X		X		X	X		X	X	X	X	X	X	
GWMMW018-U-MSD	MMW018	Water		MSD	X		X			X	X		X	X	X	X	X	X	
GWMMW018-F-MSD	MMW018	Water	X	MSD		X		X		X	X		X	X	X	X	X	X	
GWMMW020-U	MMW020	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW020-F	MMW020	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW021-U	MMW021	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW021-F	MMW021	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW022-U	MMW022	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW022-F	MMW022	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW023-U	MMW023	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW023-F	MMW023	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW024-U	MMW024	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW024-F	MMW024	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW025-U	MMW025	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW025-F	MMW025	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	

Table 5
Spring LTM Sample Tracker for Monitoring Wells and Direct Push Borehole Wells
(Page 3 of 4)

					Lab Parameters - Primary Analyte List*					Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Mn, Se (SW6020A)	Dissolved Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Water Elevation (ft amsl)	Date Sampled
GWMMW026-U	MMW026	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW026-F	MMW026	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW027-U	MMW027	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW027-F	MMW027	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW028-1-U	MMW028	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW028-1-F	MMW028	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW028-2-U	MMW028	Water		Duplicate	X		X			X	X		X	X	X	X	X	X	
GWMMW028-2-F	MMW028	Water	X	Duplicate		X		X		X	X		X	X	X	X	X	X	
GWMMW029-U	MMW029	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW029-F	MMW029	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW030-U	MMW030	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW030-F	MMW030	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW031-U	MMW031	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW031-F	MMW031	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW032-U	MMW032	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW032-F	MMW032	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW033-U	MMW033	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW033-F	MMW033	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW034-1-U	MMW034	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW034-1-F	MMW034	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW034-2-U	MMW034	Water		Duplicate	X		X			X	X		X	X	X	X	X	X	
GWMMW034-2-F	MMW034	Water	X	Duplicate		X		X		X	X		X	X	X	X	X	X	
GWMMW035-U	MMW035	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW035-F	MMW035	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW036-U	MMW036	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW036-F	MMW036	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW036-U-MS	MMW036	Water		MS	X		X			X	X		X	X	X	X	X	X	
GWMMW036-F-MS	MMW036	Water	X	MS		X		X		X	X		X	X	X	X	X	X	
GWMMW036-U-MSD	MMW036	Water		MSD	X		X			X	X		X	X	X	X	X	X	
GWMMW036-F-MSD	MMW036	Water	X	MSD		X		X		X	X		X	X	X	X	X	X	
GWMMW037-1-U	MMW037	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMMW037-1-F	MMW037	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
GWMMW037-2-U	MMW037	Water		Duplicate	X		X			X	X		X	X	X	X	X	X	
GWMMW037-2-F	MMW037	Water	X	Duplicate		X		X		X	X		X	X	X	X	X	X	
GWMW-15A-U	MW-15A	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMW-15A-F	MW-15A	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	

Table 5
Spring LTM Sample Tracker for Monitoring Wells and Direct Push Borehole Wells
(Page 4 of 4)

					Lab Parameters - Primary Analyte List*					Field Parameters									
Field Sample Identification [a]	Location	Matrix	Filtered (check for yes)	QC Sample Type	Total Cd, Mn, Se (SW6020A)	Dissolved Se (SW6020A)	TDS (E 160.1)	S04 (EPA 300.0)		Specific Conductivity (µS/cm @ 25°C)	pH	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Water Elevation (ft amsl)	Date Sampled
GWMW-16A-U	MW-16A	Water		Primary	X		X			X	X		X	X	X	X	X	X	
GWMW-16A-F	MW-16A	Water	X	Primary		X		X		X	X		X	X	X	X	X	X	
B-GW-01-U	na	Water		B	X		X												
B-GW-01-F	na	Water	X	B		X		X											

Cd - Cadmium	µS/cm	microsiemens per centimeter		
Mn - Manganese	% sat	percent saturation	°C	Degrees celsius
Se - Selenium	mg/L	Milligrams per liter	ft^3/sec	cubic feet per second
SO_4 - Sulfate	mV	Millivolts		
TDS - Total Dissolved Solids	ftu	Formazin Turbidity Unit		

O - Direct-push monitoring wells will be sampled for total and dissolved fraction when the turbidity is less than 5 NTU.

If the turbidity is greater than 5 NTU, then the sample will be analyzed for the dissolved fraction only.

B – source water blank sample, to be taken once at the beginning of each sampling event and whenever new source water is used.

ID - identification

na - not applicable

QC - quality control

TBD - to be determined, analyte list for MBW112 and MMW012 will be determined in consult with A/Ts if water is encountered and the well recovers following purging

Primary QC sample indicates that it is the first samples collected.

[a] Sample Identification will also include a date prefix reflecting the year and month the sample was taken. For example, a sample taken in June of 2013 would have a prefix of (1306) followed by the normal sample ID

[*] The primary analyte list is presented in Table 1

MBW - Borehole Monitoring Well (direct-push pre-packed screen monitoring well)

MMW - Monitoring Well

Borehole Monitoring Wells (direct push) are differentiated from “regular or standard” monitoring wells based on their methods and means of completion. In general, they have a smaller diameter and a shorter pre-packed screened interval than the regular wells.

ATTACHMENT 1
2009 AND 2010 SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN

ATTACHMENT 2
2009 GROUNDWATER MONITORING
SAMPLING AND ANALYSIS PLAN

ATTACHMENT 3
2010 GROUNDWATER MONITORING MEMORANDUM

ATTACHMENT 4
2012 SURFACE WATER AND GROUNDWATER MEMORANDUM

ATTACHMENT 5
RESPONSES TO A/T COMMENTS

P4's Responses to Compiled A/T comments, dated March 26, 2013 on the *Proposed P4 Long-Term Surface and Groundwater Monitoring Plan* Prepared by MWH, dated March 4, 2013

April 5, 2013

Specific Comments

1. **Cover Letter/Proposed Plan, Page 1, 2nd paragraph:** The text states "As conducted in the past, it is anticipated that the LTM program for groundwater and surface water sampling will be performed during two sampling rounds each year; one in the spring and the other in the fall." This contradicts the statement on Page 3 of this same document that states "As shown on Table 4, no fall GW sampling is proposed." Recommend revising for clarity and consistency regarding frequency of groundwater sampling. In addition, Table 4 is titled "LTM Groundwater Monitoring Well and Borehole Well Locations" and as such, does not include frequency of sampling, which is confusing given the statement on Page 3. Recommend revising for consistency and clarity. Lastly, it does not appear that the work product for reporting the long-term monitoring data has been identified. It is recommended that the data be reported in bi-annual reports due within three months of P4's receipt of the validated data. That way the Agencies will receive the groundwater data in a timely manner and be able to modify the proposed sampling frequency if needed.

   P4 Response: *To address the contradiction between the spring and fall sampling for groundwater, page 1, 2nd paragraph will be revised as follows:*

   "As conducted in the past, it is anticipated that the LTM program for groundwater and surface water sampling will be performed during two sampling rounds each year; one in the spring for both surface water and groundwater and the other in the fall for surface water only."

   To address consistency on Table 4, a column will be added to show the frequency for groundwater sampling (i.e., spring).

   Regarding transmittal of the spring and fall data, P4 will continue to submit all validated data and data validation summaries for each sampling effort within 120 days of sample collection as required by Task B Data Management in the 2009 AOC/CO Scope of Work (SOW). In addition yearly Data Summary Reports will be submitted to the A/T per the SOW.

2. **Cover Letter/Proposed Plan, Page 1, 1st bullet:** The text indicates that surface water sampling locations MST0226, MST274 and MST275 are proposed to be eliminated from the long-term monitoring plan. According to the EPA letter to P4 dated May 25, 2012, data from MST274 and MST275 will be beneficial for the RI/FSs at Henry and Enoch Valley mines. As such, it is recommended these sampling locations be retained regardless of their status as background locations. In addition,

preliminary 2012 data for MST0226 indicates a selenium concentration of .00833 mg/L and a sulfate concentration of 29.7 mg/L, both indicative of mine waste rock-associated water. MST0226 is also downstream of Wooley Valley Mine. For these reasons it is recommended this sample location be retained as well for the long-term monitoring plan.

P4 Response: *P4 does agree to retain MST274, MST275, and MS226, although disagrees that a sulfate value of 29.7 mg/L alone is indicative of mine waste rock-associated water (sulfate concentrations in background station MST235 range between 2 and 47 mg/L). Changes to the text, Tables 2 and 3, and Figures 1, 3 and 4 will be made accordingly.*

3. **Cover Letter/Proposed Plan, Page 2, 1st bullet:** For the present, the A/T agrees that long-term monitoring of the specified background surface water locations (MST048 and MST093) is unnecessary, and consistent with DQOs. However, the A/T reserves the right to require that these background locations be sampled in the future, as surface water and groundwater are transitory media and questions or uncertainties may arise during preparation of the Henry and Enoch Valley Mines RI Reports. Please consider and explain how a lapse in time for background locations (but not the monitoring locations) will be accounted for in the site characterization.

   P4 Response: *So noted. Background for any Site typically is developed once and isn't evaluated further no matter what the time frame is between site-specific investigations and RI reports that are prepared subsequently. As the proposed background threshold values (BTV) values were collected in unaffected, headwater locations, are conservative, and are statistically derived from a larger data set spanning years of sampling events between 2004 and 2010, P4 does not believe that lapse in time between the background sampling events and the development of future RI Report will affect Site characterizations or risk discussions in these reports. The 2012 background data set does not show significant seasonal or yearly variations that would support additional long-term monitoring of two of these background stations.*

4. **Page 2, second paragraph:** Regarding fall surface water sampling, P4 states: "The fall sampling decision will use both the spring LTM data and historical data to determine which stations, if any, need to be re-sampled in the fall." Revise the text to include a process to notify to inform the A/T of which surface water locations will or will not be sampled in the fall. The notification should include sufficient rationale for the decisions. The notification should be submitted to the A/T at least three weeks before the fall sample event, as practicable.

   P4 Response: *Agreed. P4 has notified the A/T of the proposed fall sampling stations at least three weeks prior to the events in both 2010 and 2012. Text will be added to page 2, second paragraph to add this requirement.*

5. **Cover Letter/Proposed Plan, Page 2, last bullet bottom of the page:** See comment above regarding the relevancy of background evaluations for transitory media when some RI Report(s) may not be completed for another two years or more.

   P4 Response: *See response to Comment No. 3, above.*

6. **Page 3, sentence at top of page:** Recommend that P4 delete the sentence “P4 is receptive to discussing future monitoring of these background GW locations based on any long-term changes in GW conditions that are revealed by the LTM program or other A/T concerns.” As noted above, the A/T reserves the right to require that these background locations be sampled in the future, as warranted.

   P4 Response: *Agreed. See response to Comment No. 3 above.*

7. **Table 1.**

   - Please identify in the Table the field parameters that will be measured.

   - Please consider sampling all surface water for dissolved selenium. In case of high turbidity/high suspended solids in a sample, a higher than expected selenium concentration can at least be explained if data for dissolved selenium are available.

   - As seeps and springs are considered surface expressions of groundwater, would it make sense for seeps and springs, like groundwater, to be sampled for unfiltered cadmium and manganese, too? Please consider

   P4 Response:

     - *P4 will list field parameters for surface water and ground water in Table 1 and will refer to Tables 3 and 5 where each field parameter is listed as part of the sample tracker tables.*
     - *Agreed. P4 will add dissolved selenium to both the long-term groundwater and surface water programs to aid in evaluation of data in the case of turbid sample, which are encountered in some wells/stations at the Sites. Revisions to Tables 1, 3, and 5 will be made to reflect this response.*
     - *P4 acknowledges that because the seeps and springs are used for characterizing both surface water and groundwater, there is some logic for having both analytical suites included. However, it is P4’s opinion that “unfiltered” totals data are problematic for seep/spring samples. This is because seasonal turbidity is likely to affect the data from these location, resulting in abnormally high cadmium and magnesium values when compared to nearby groundwater samples which will be unaffected by spring runoff (i.e., no change in turbidity with the season). As a result, P4 requests that these constituents not be added to the analyte list for seeps and springs.*

Editorial

Page 2, paragraph 7, line 7. Change "draught" to "drought" and change "round" to "round of sampling."

P4 Response: *Agreed. The LTM Plan will be revised to incorporate these revisions.*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
IDAHO OPERATIONS OFFICE
1435 N. Orchard St.
Boise, Idaho 83706

April 15, 2013

Rachel Roskelley
Sr. Environmental Engineer
Monsanto Company
Soda Springs Operations
1853 Highway 34
Soda Springs, Idaho 83276

Re: A/T Approval with Modifications of Proposed P4 Long-Term Surface Water and Groundwater Monitoring Plan and associated Responses to Comments, prepared for P4 Production by MWH, and dated April 5, 2013.

Dear Ms Roskelley,

The Agencies and Tribes (A/T) have reviewed the above referenced deliverable submitted electronically by P4. This work product was developed pursuant to the 2009 RI/FS Settlement Agreement. We are now providing approval with modifications of the subject document. Please incorporate the direction provided in the enclosure and submit a revised final document, and distribute this deliverable per the terms of the Settlement Agreement.

Please contact me if you have questions. I can be reached at 208-378-5763 or electronically at tomten.dave@epa.gov.

Sincerely,

//s//

Dave Tomten
Remedial Project Manager

Enclosure

cc: Cary Faulk, MWH (electronic version only)
Vance Drain, MWH (electronic version only)
Mike Rowe, IDEQ
Mary Kaufman, FS
Forest Service - Enoch Valley Site Record

Printed on Recycled Paper

Sandi Fisher, US FWS
Mark Jankowski, US FWS
Kelly Wright, Shoshone Bannock Tribes
Susan Hanson (for the tribes)
Talia Martin, Shoshone Bannock Tribes (electronic version only)
Colleen O'Hara, BLM (electronic version only)
Eldine Stevens, BIA (electronic version only)
Bob Blaesing, BIA (electronic version only)
Tim Mosko, CH2MHill (electronic version only)
Charles Allbritton, EPA Records Center (electronic version only)

A/T Direction and Review of Responses to Comments on the Proposed P4 Long-Term Surface and Groundwater Monitoring Plan

Specific Comments

1. Cover Letter/Proposed Plan, Page 1, 2nd paragraph: The text states "As conducted in the past, it is anticipated that the LTM program for groundwater and surface water sampling will be performed during two sampling rounds each year; one in the spring and the other in the fall." This contradicts the statement on Page 3 of this same document that states "As shown on Table 4, no fall GW sampling is proposed." Recommend revising for clarity and consistency regarding frequency of groundwater sampling. In addition, Table 4 is titled "LTM Groundwater Monitoring Well and Borehole Well Locations" and as such, does not include frequency of sampling, which is confusing given the statement on Page 3. Recommend revising for consistency and clarity. Lastly, it does not appear that the work product for reporting the long-term monitoring data has been identified. It is recommended that the data be reported in bi-annual reports due within three months of P4's receipt of the validated data. That way the Agencies will receive the groundwater data in a timely manner and be able to modify the proposed sampling frequency if needed.

P4 Response: *To address the contradiction between the spring and fall sampling for groundwater, page 1, 2nd paragraph will be revised as follows:*

"As conducted in the past, it is anticipated that the LTM program for groundwater and surface water sampling will be performed during two sampling rounds each year; one in the spring for both surface water and groundwater and the other in the fall for surface water only."

To address consistency on Table 4, a column will be added to show the frequency for groundwater sampling (i.e., spring).

Regarding transmittal of the spring and fall data, P4 will continue to submit all validated data and data validation summaries for each sampling effort within 120 days of sample collection as required by Task B Data Management in the 2009 AOC/CO Scope of Work (SOW). In addition yearly Data Summary Reports will be submitted to the A/T per the SOW.

A/T Response: Accepted. FYI, on further review of the SOW, we noted inconsistencies between the Deliverables due dates in the text of the SOW and in Attachment A, Schedule. The SOW text states DVS are due within 120 calendar days from the date of collection of the last sample from each sampling event and the Schedule states that DVS are due within 90 days from the last sampling event. 120 days is acceptable.

2. Cover Letter/Proposed Plan, Page 1, 1st bullet: The text indicates that surface water sampling locations MST0226, MST274 and MST275 are proposed to be eliminated from the long-term monitoring plan. According to the EPA letter to P4 dated May 25, 2012, data from MST274 and MST275 will be beneficial for the RI/FSs at Henry and Enoch Valley mines. As such, it is recommended these sampling locations be retained regardless of their status as background locations. In addition, preliminary 2012 data for MST0226 indicates a selenium concentration of .00833 mg/L and a sulfate concentration of 29.7 mg/L, both indicative of mine waste rock associated water. MST0226 is also downstream of Wooley Valley Mine. For these reasons it is recommended this sample location be retained as well for the long-term monitoring plan.

P4 Response: *P4 does agree to retain MST274, MST275, and MS226, although disagrees that a sulfate value of 29.7 mg/L alone is indicative of mine waste rock associated water (sulfate concentrations in background station MST235 range between 2 and 47 mg/L). Changes to the text, Tables 2 and 3, and Figures 1, 3 and 4 will be made accordingly.*

A/T response: OK.

3. Cover Letter/Proposed Plan, Page 2, 1st bullet: For the present, the A/T agrees that long-term monitoring of the specified background surface water locations (MST048 and MST093) is unnecessary, and consistent with DQOs. However, the A/T reserves the right to require that these background locations be sampled in the future, as surface water and groundwater are transitory media and questions or uncertainties may arise during preparation of the Henry and Enoch Valley Mines RI Reports. Please consider and explain how a lapse in time for background locations (but not the monitoring locations) will be accounted for in the site characterization.

P4 Response: *So noted. Background for any Site typically is developed once and isn't evaluated further no matter what the time frame is between site-specific investigations and RI reports that are prepared subsequently. As the proposed background threshold values (BTV) values were collected in unaffected, headwater locations, are conservative, and are statistically derived from a larger data set spanning years of sampling events between 2004 and 2010, P4 does not believe that lapse in time between the background sampling events and the development of future RI Report will affect Site characterizations or risk discussions in these reports. The 2012 background data set does not show significant seasonal or yearly variations that would support additional long-term monitoring of two of these background stations.*

A/T Response: Accepted.

4. Page 2, second paragraph: Regarding fall surface water sampling, P4 states: "The fall sampling decision will use both the spring LTM data and historical data to determine which stations, if any, need to be re-sampled in the fall." Revise the text to include a process to notify to inform the A/T of which surface water locations will or will not be sampled in the fall. The notification should include sufficient rationale for the decisions. The notification should be submitted to the A/T at least three weeks before the fall sample event, as practicable.

P4 Response: *Agreed. P4 has notified the A/T of the proposed fall sampling stations at least three weeks prior to the events in both 2010 and 2012. Text will be added to page 2, second paragraph to add this requirement.*

A/T Response: Accepted.

5. Cover Letter/Proposed Plan, Page 2, last bullet bottom of the page: See comment above regarding the relevancy of background evaluations for transitory media when some RI Report(s) may not be completed for another two years or more.

P4 Response: *See response to Comment No. 3, above.*

A/T: OK.

6. Page 3, sentence at top of page: Recommend that P4 delete the sentence "P4 is receptive to discussing future monitoring of these background GW locations based on any long-term changes in GW conditions that are revealed by the LTM program or other A/T concerns." As noted above, the A/T reserves the right to require that these background locations be sampled in the future, as warranted.

P4 Response: *Agreed. See response to Comment No. 3 above.*

A/T: OK

7. Table 1.

- Please identify in the Table the field parameters that will be measured.
- Please consider sampling all surface water for dissolved selenium. In case of high turbidity/high suspended solids in a sample, a higher than expected selenium concentration can at least be explained if data for dissolved selenium are available.
- As seeps and springs are considered surface expressions of groundwater, would it make sense for seeps and springs, like groundwater, to be sampled for unfiltered cadmium and manganese, too? Please consider.

P4 Response:

- *P4 will list field parameters for surface water and ground water in Table 1 and will refer to Tables 3 and 5 where each field parameter is listed as part of the sample tracker tables.*
- *Agreed. P4 will add dissolved selenium to both the long-term groundwater and surface water programs to aid in evaluation of data in the case of turbid sample, which are encountered in some wells/stations at the Sites. Revisions to Tables 1, 3, and 5 will be made to reflect this response.*
- *P4 acknowledges that because the seeps and springs are used for characterizing both surface water and groundwater, there is some logic for having both analytical suites included. However, it is P4's opinion that "unfiltered" totals*

> *data are problematic for seep/spring samples. This is because seasonal turbidity is likely to affect the data from these location, resulting in abnormally high cadmium and magnesium values when compared to nearby groundwater samples which will be unaffected by spring runoff (i.e., no change in turbidity with the season). As a result, P4 requests that these constituents not be added to the analyte list for seeps and springs.*

A/T: On the third bullet regarding collection of unfiltered (in addition to filtered) samples for Cd and Mg, we agreed that this is a matter of technical judgment, and accept the proposal to retain the analyte list from previous sample collection efforts which calls for collection of just filtered samples for Cd and Mg.

Editorial Comments

A/T: It did not appear that the editorial changes requested earlier (change “draught” to “drought”, and “round” to “round of sampling”) were made in the redline version. Please incorporate.

8. Additional A/T Direction: There appears to be some ambiguity regarding collection of groundwater elevation data, as this is not specifically described in the letter or listed in Table 5 but is an SOP referenced in the 2009 work plan. This information is necessary to interpret sampling data. Thus, revise to clarify to that groundwater elevation data will be collected whenever water samples are collected from groundwater monitoring wells, by including water level measurement in Table 5.

ATTACHMENT 6
RESPONSES TO A/T COMMENTS

P4's Responses to Compiled A/T comments, dated April 3, 2014 on the
Proposed P4 Long-Term Surface and Groundwater Monitoring Plan –Draft Rev0-2014
Prepared for P4 Production by MWH, dated April 8, 2014.

General Comments

1. EPA's QA Office has reviewed the proposed monitoring plan, which is tiered to the approved 2009/2010 SAP and QAPP. It appears that methods and reporting limits are current and adequate to meet project requirements. In addition, data validation and QA/QC procedures have not changed and are adequate to meet project requirements.

As a note for future reference, EPA's QA office expects QA plans to be closed out after a period of five years, and then re-issued with any necessary changes. This ensures that plans remain up-to-date. For long-term sampling in 2015, please plan to re-issue the SAP.

P4 Response: *Based on your request, a comprehensive LTM SAP will be prepared in 2015 for the Sites. It will no longer be tied to the approved 2009/2010 SAP and QAPP but instead will be a stand-alone SAP for the Surface Water and Groundwater LTM Sampling Program for the Sites. It should be noted that by using this approach these yearly update plans likely can be avoided after 2015 because a single stand-alone SAP will guide LTM.*

2. It is recommended that the monitoring well locations (in GPS UTM coordinates or lat/long coordinates with the specific units described (ex. degrees, decimal minutes)) be included in the groundwater monitoring data reporting tables so the Agencies can confirm the same location is being sampled from year to year.

P4 Response: *The GPS UTM coordinates or lat/long coordinates will be collected during the 2014 and future sampling rounds for the surface water and groundwater monitoring well locations. These points then will be included in the data reporting tables as part of the 2014 Data Summary Report. A column was added to the Field Parameter section of the 2014 LTM SAP Tables 3 and 5 for GPS coordinate collection. Tables 2 and 3 of the 2015 LTM SAP also will be updated with the most recent coordinates.*

Specific Comments

1. Page 1, 2nd paragraph. It is recommended to include a statement that the interim sampling proposed in this plan allows for a continuous dataset for groundwater and surface water to bridge the time gap between the years of site characterization data (identified here as 2004-2008) and completion of the Feasibility Study for each mine site. It should be noted that the most recent site characterization data for groundwater and surface water are now at least five years old.

P4 Response: *This recommendation is already included as part of the individual discussions for SW and GW on:*

1) Page 1, 3rd paragraph for SW: "The objective of SW monitoring conducted at the Sites from 2004 through 2008 was to support nature and extent characterizations of impacts to water quality associated with releases to SW from potential sources. In 2009, the SW monitoring program transitioned from a characterization to an interim monitoring program that provides an annual assessment of SW conditions downstream of potential sources associated with each Site. The objective of the sampling conducted since 2009 is to establish long-term data trends and assist with the development of site-specific remedies at individual mines."

2) Page 2, 2nd and 3rd paragraphs for GW: "Characterization of GW at the Sites has been conducted in a phased approach since 2004… The objectives of the GW monitoring that occurred in the 2010, 2012, and 2013 sampling programs are essentially the same. The groundwater data collected under these plans support the evaluation of SW / GW interaction and refinement of the hydrogeologic conceptual models of the Sites. In addition, ongoing LTM monitoring of GW constituents concentrations and piezometric conditions in monitoring wells are needed to support the evaluation of remedies in the FS and implementation of the sites Selected Remedies during any corrective action that may be necessary. Sampling of these monitoring well locations also allows for an understanding of potential long-term GW trends, especially following the implementation of the Selected Remedy at each of the Sites.

2. **Page 2, Manganese.** We disagree that manganese should be discontinued as an analyte under this plan. Please retain Mn as an analyte. The justification provided by P4 focused on the Ballard Mine, and would not necessarily apply to Henry or Enoch Valley.

   P4 Response: *P4 agrees to retain total manganese (Mn) as a groundwater analyte for the 2014 LTM sampling program with the understanding that the total Mn results will again be re-evaluated in 2015 for inclusion in the LTM sampling program. This re-evaluation will be based on comparisons of newly collected 2014 data with past sampling results, as is provided in the Remedial Investigations (RI) Report for the Ballard Mine Site. Evaluation of 2014 and historical data collected from groundwater sampling locations at Henry and Enoch Valley Mines will be included in their RI Reports in a similar manner. These evaluations of Mn data over numerous years will determine if continued monitoring for total Mn concentrations is warranted.*

Editorial Comments

1. Page 2, paragraph 2, line 10. Delete the semicolon preceding "will".

2. Page 2, bullet 2. Delete "and the"

3. Page 2, bullet 3. Change to ". . . Memo, and the"

4. Page 2, paragraph 4, line 1. Move "*2013 LTM Plan*" to a fourth (last) bullet above.

P4 Response: *The LTM Plan will be revised to incorporate these revisions.*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
IDAHO OPERATIONS OFFICE
950 West Bannock, Suite 900
Boise, Idaho 83702

April 17, 2014

Rachel Roskelley
Sr. Environmental Engineer
Monsanto Company
Soda Springs Operations
1853 Highway 34
Soda Springs, Idaho 83276

Re: Approval of *Proposed P4 Long-Term Surface Water and Groundwater Monitoring Plan – Final Rev 0 - 2014*, dated April 8, 2014.

Dear Ms. Roskelley,

The Agencies and Tribes (A/T) have reviewed and approve the above referenced memorandum and attachments describing the proposed surface water and groundwater monitoring activities for 2014. This deliverable is submitted pursuant to the Administrative Settlement Agreement and Order on Consent/Consent Order for Performance of Remedial Investigation and Feasibility Study at the Enoch, Henry, and Ballard Mine Sites in Southeastern Idaho (or 2009 AOC).

Please produce and distribute a final version of the plan. As we have discussed in the past, some agencies have provided direction that it is acceptable to provide an electronic version of the final deliverable on a CD (rather than both a hardcopy and electronic copy). Please contact me if you have questions. I can be reached at 208-378-5763 or electronically at tomten.dave@epa.gov.

Sincerely,

//s//

Dave Tomten
Remedial Project Manager

cc: Cary Faulk, MWH (electronic version only)
Vance Drain, MWH (electronic version only)
Mike Rowe, IDEQ – Pocatello
Sandi Fisher, US FWS - Chubbuck
Kelly Wright, Shoshone Bannock Tribes
Susan Hanson (for the tribes)
Talia Martin, Shoshone Bannock Tribes (electronic version only)
Mary Kaufman, FS – Pocatello
Colleen O'Hara, BLM

Eldine Stevens, BIA (electronic version only)
Bob Blaesing, BIA (electronic version only)
Tim Mosko, CH2MHill (electronic version only)
Charles Allbritton, EPA Records Center (electronic version only)
Don Matheny, EPA R10 QA Office (electronic version only)